

# ENGINE

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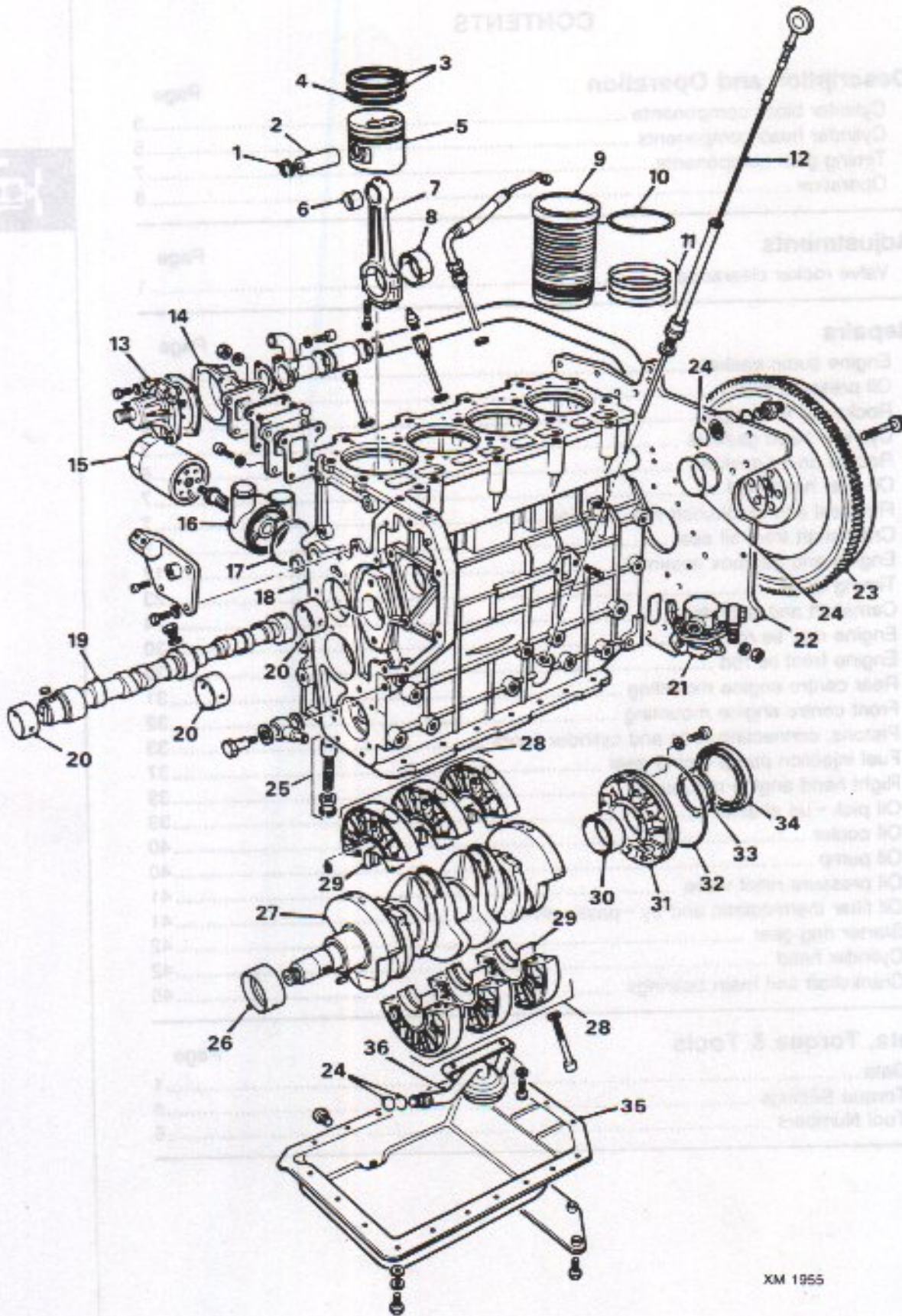
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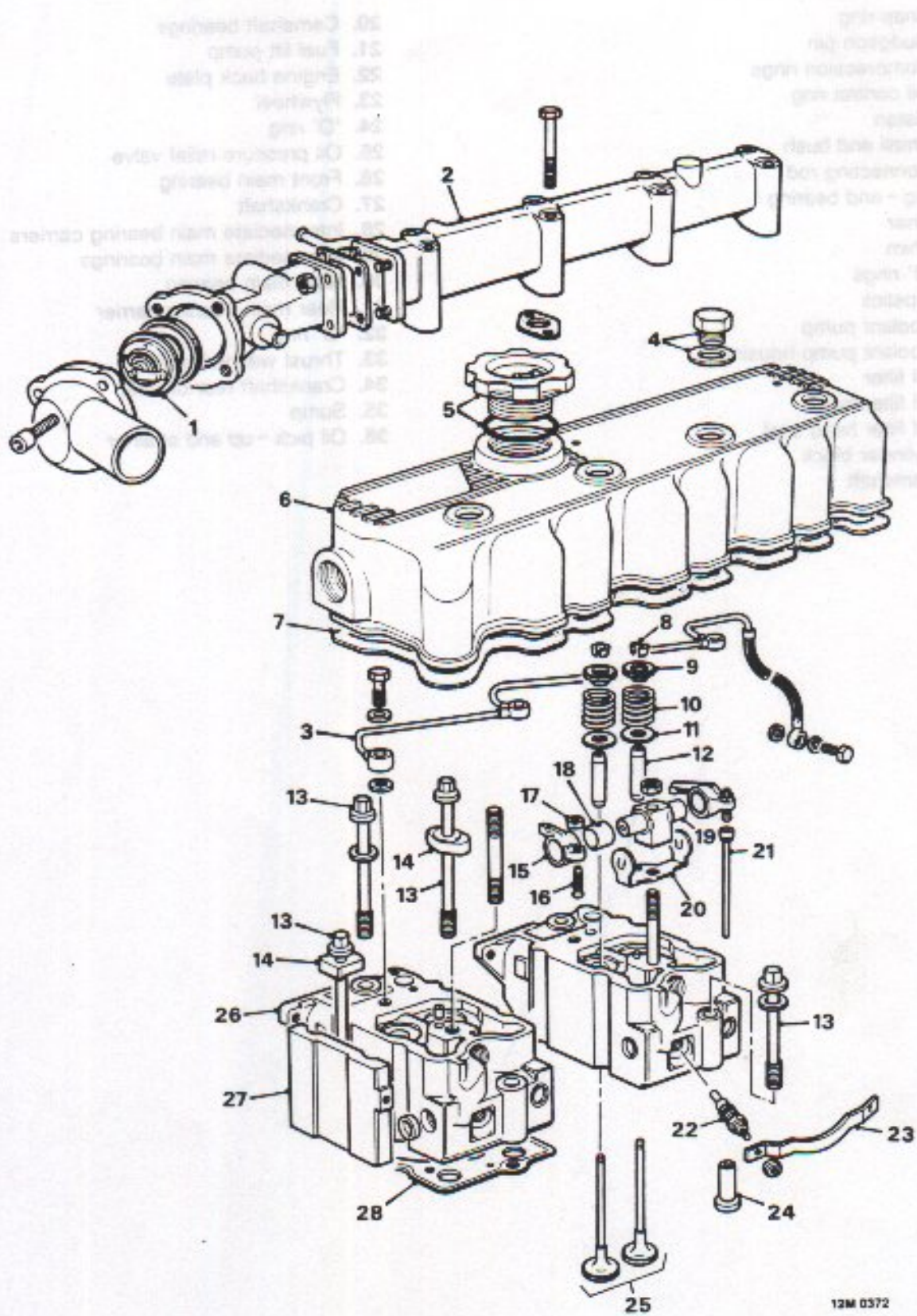


XM 1955



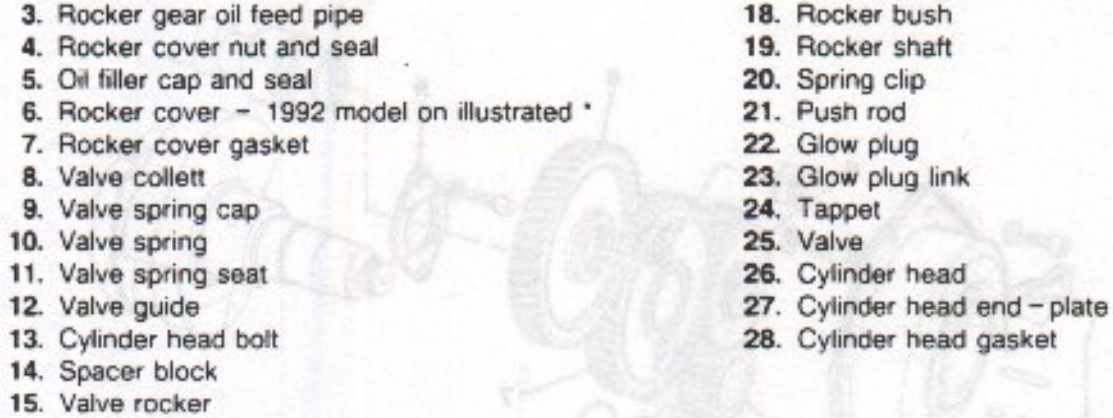
## CYLINDER BLOCK COMPONENTS

- 
1. Snap ring  
 2. Gudgeon pin  
 3. Compression rings  
 4. Oil control ring  
 5. Piston  
 6. Small end bush  
 7. Connecting rod  
 8. Big - end bearing  
 9. Liner  
 10. Shim  
 11. 'O' rings  
 12. Dipstick  
 13. Coolant pump  
 14. Coolant pump housing  
 15. Oil filter  
 16. Oil filter head  
 17. Oil filter head seal  
 18. Cylinder block  
 19. Camshaft  
 20. Camshaft bearings  
 21. Fuel lift pump  
 22. Engine back plate  
 23. Flywheel  
 24. 'O' ring  
 25. Oil pressure relief valve  
 26. Front main bearing  
 27. Crankshaft  
 28. Intermediate main bearing carriers  
 29. Intermediate main bearings  
 30. Rear main bearing  
 31. Rear main bearing carrier  
 32. 'O' ring  
 33. Thrust washer halves  
 34. Crankshaft rear oil seal  
 35. Sump  
 36. Oil pick - up and strainer



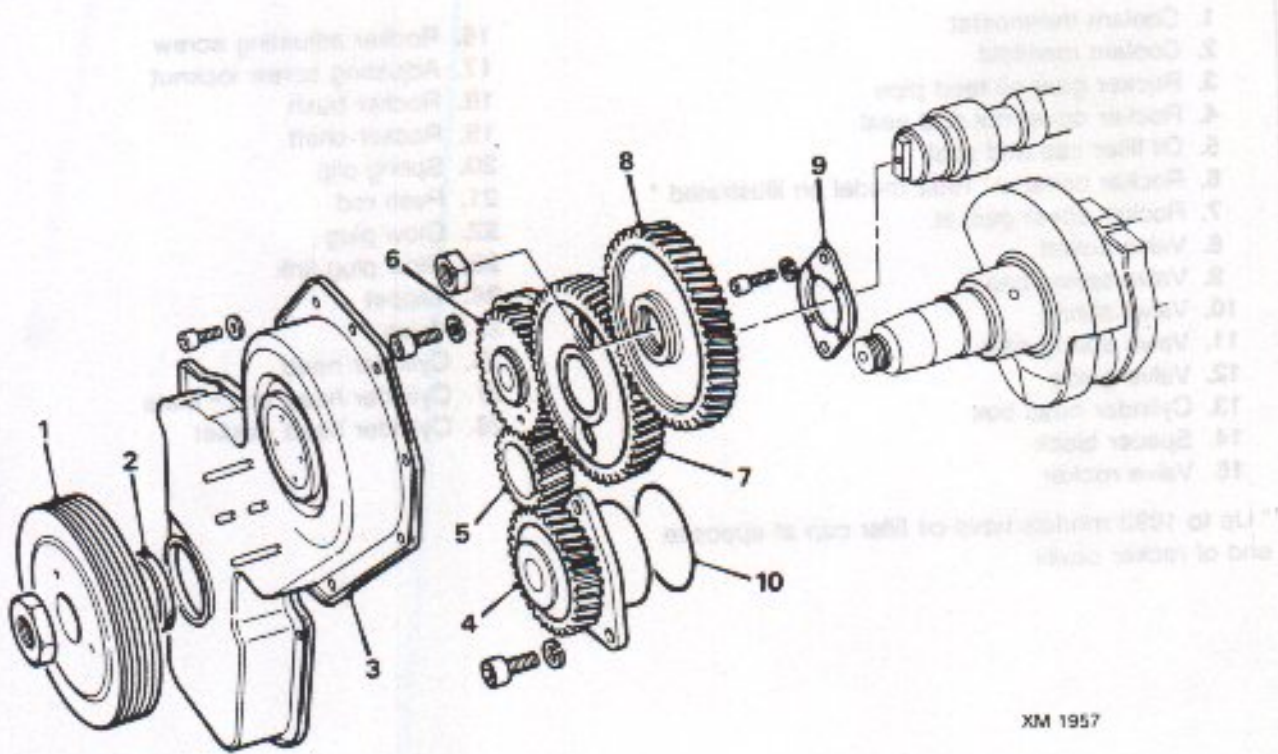
13M 0372

**CYLINDER HEAD COMPONENTS**

- 
1. Coolant thermostat
  2. Coolant manifold
  3. Rocker gear oil feed pipe
  4. Rocker cover nut and seal
  5. Oil filler cap and seal
  6. Rocker cover - 1992 model on illustrated \*
  7. Rocker cover gasket
  8. Valve collett
  9. Valve spring cap
  10. Valve spring
  11. Valve spring seat
  12. Valve guide
  13. Cylinder head bolt
  14. Spacer block
  15. Valve rocker
  16. Rocker adjusting screw
  17. Adjusting screw locknut
  18. Rocker bush
  19. Rocker shaft
  20. Spring clip
  21. Push rod
  22. Glow plug
  23. Glow plug link
  24. Tappet
  25. Valve
  26. Cylinder head
  27. Cylinder head end - plate
  28. Cylinder head gasket

\* Up to 1992 models have oil filler cap at opposite end of rocker cover.

CYLINDER HEAD COMPONENTS



XM 1957



**TIMING GEAR COMPONENTS**

1. Crankshaft pulley
2. Crankshaft front oil seal
3. Timing cover
4. Oil pump drive gear
5. Crankshaft gear
6. Vacuum pump drive gear

7. Camshaft drive gear
8. Injection pump drive gear
9. Camshaft locating plate
10. Oil pump 'O' ring

OPERATION

with cast iron cylinder  
individual fast for  
The crankshaft is  
from bearing at each end  
ball bearings located in aluminum alloy carrier  
Crankshaft end - fast is controlled by timing  
washers mounted in the rear of the rear main  
bearing carrier.

Drive for the camshaft, injection pump, oil pump  
and vacuum pump is from the front of the  
crankshaft through a train of gears.

Valve operation is by push-rod and rocker, each  
rod of rocker being mounted on their own  
individual shaft which is mounted on one of the  
individual cylinder heads. A single rocker cover  
covers all four cylinder heads.

## OPERATION

The engine is a four cylinder water cooled unit with cast iron cylinder block, wet liners and an individual head for each cylinder.

The crankshaft is supported by a one - piece bush type bearing at each end and three intermediate shell bearings located in aluminium alloy carriers. Crankshaft end - float is controlled by thrust washers mounted in the rear of the rear main bearing carrier.

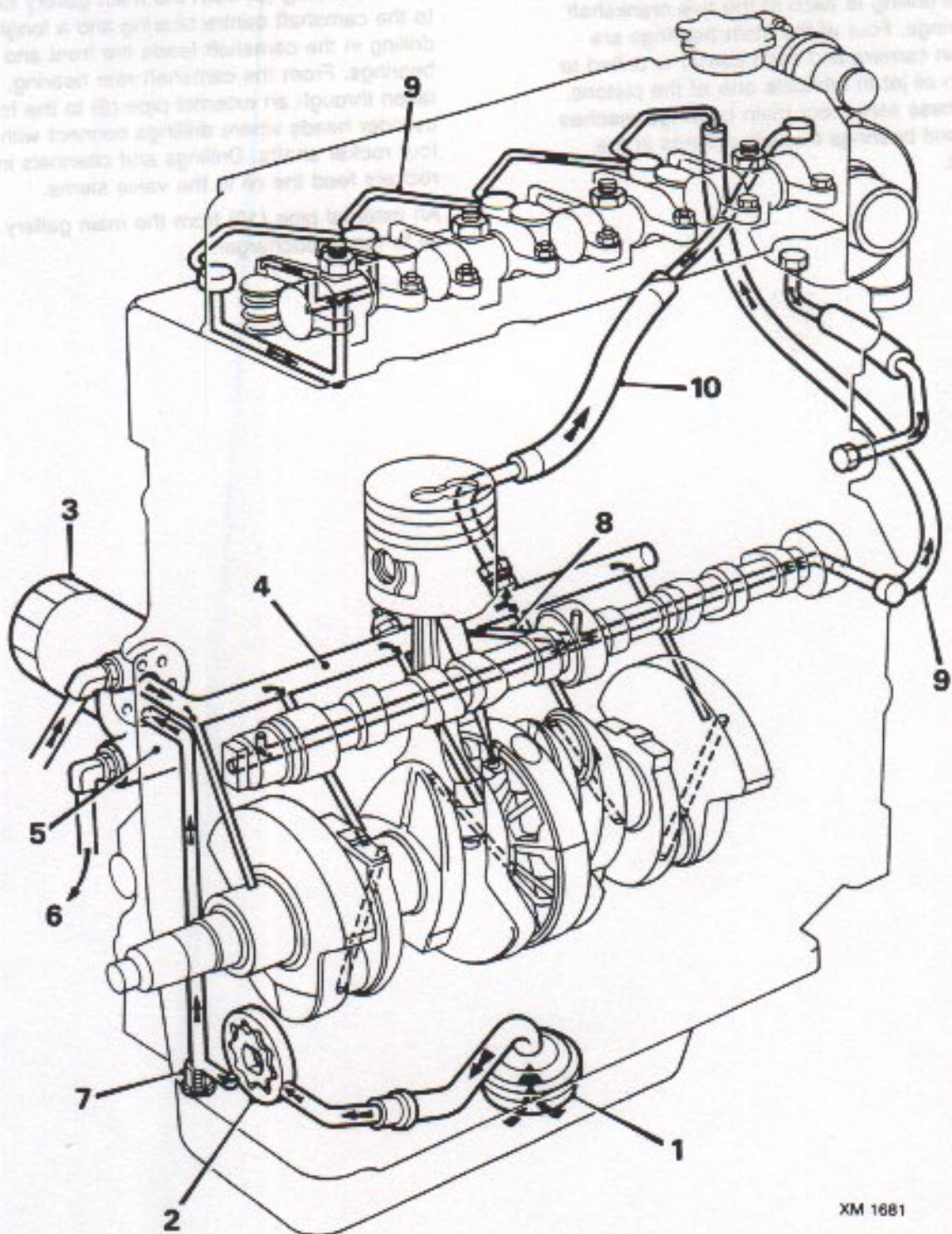
Drive for the camshaft, injection pump, oil pump and vacuum pump is from the front of the crankshaft through a train of gears.

Valve operation is by push - rod and rocker, each pair of rockers being mounted on their own individual shaft which is mounted on one of the individual cylinder heads. A single rocker cover spans all four cylinder heads.

## TIMING GEAR COMPONENTS

1. Crankshaft gear
2. Crankshaft front oil seal
3. Timing cover
4. Oil pump drive gear
5. Crankshaft gear
6. Vacuum pump drive gear





XM 1681

### Lubrication

Oil is drawn through a strainer (1) in the sump, into the oil pump (2) mounted in the front of the crankcase. The oil is then pumped through a full flow filter (3), mounted on the side of the crankcase, and into the main oil gallery (4).

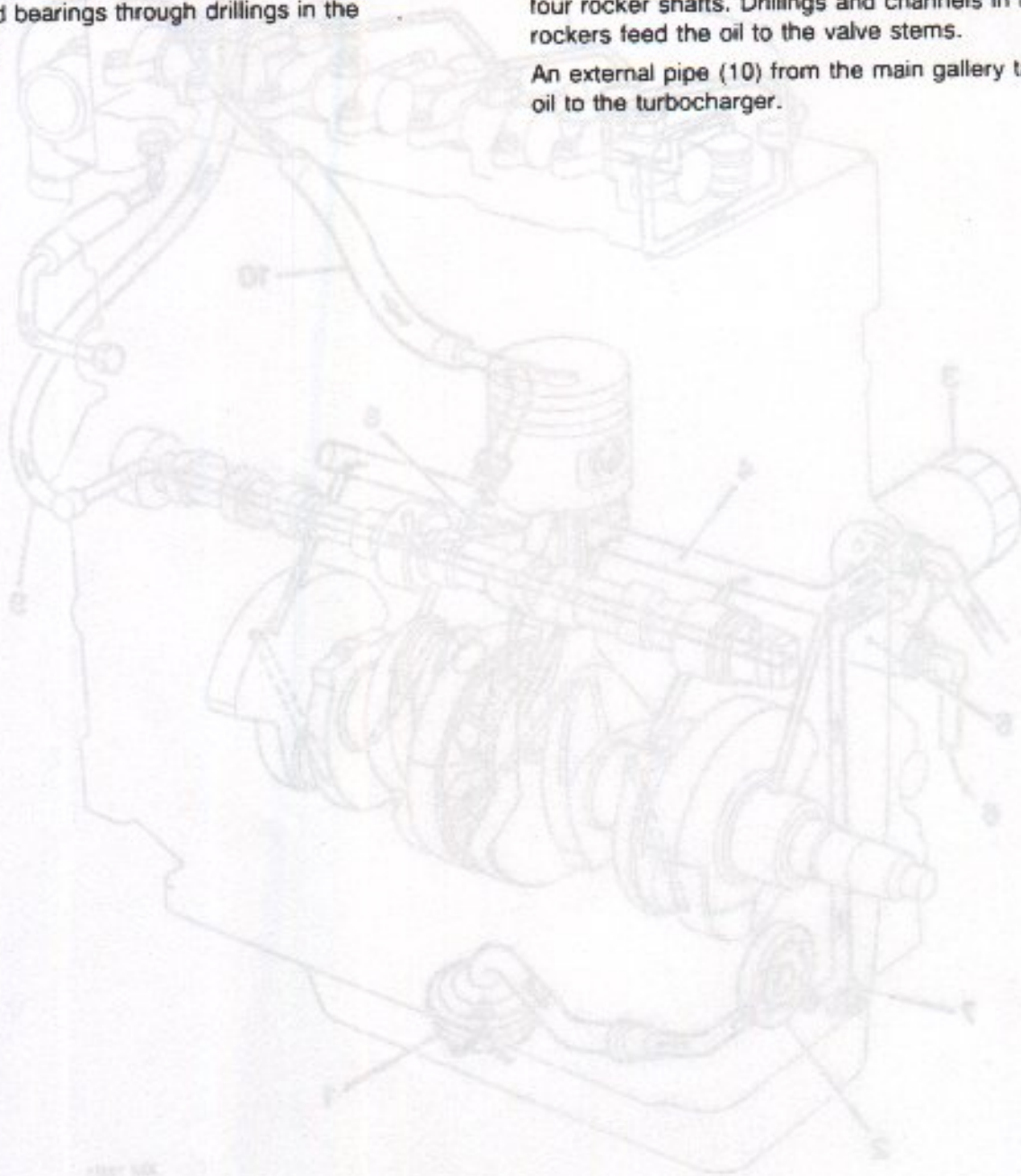
A thermostatic valve (5) in the filter head directs oil through the oil cooler (6) before filtering when oil temperature exceeds 80°C. Also incorporated in the filter head is a pressure operated by-pass valve which diverts the hot oil directly into the filter if a restriction occurs in the oil cooler.

Oil pressure is controlled by a pressure relief valve (7) in the crankcase below the main oil gallery.

From the main oil gallery, oil is fed through crankcase drilling to each of the five crankshaft main bearings. Four of the main bearings are mounted in carriers and each carrier is drilled to provide an oil jet to lubricate one of the pistons. Oil from these same four main bearings reaches the big - end bearings through drillings in the crankshaft.

A cross drilling (8) from the main gallery carries oil to the camshaft centre bearing and a longitudinal drilling in the camshaft feeds the front and rear bearings. From the camshaft rear bearing, oil is taken through an external pipe (9) to the four cylinder heads where drillings connect with the four rocker shafts. Drillings and channels in the rockers feed the oil to the valve stems.

An external pipe (10) from the main gallery takes oil to the turbocharger.



A lubrication system is provided for the engine. Oil is drawn from a sump (1) in the crankcase and is pumped to the main oil gallery (2) by the oil pump (3) mounted in the front of the crankcase. The oil is then distributed through a network of passages (4) to the various bearings and components. The oil is then collected in the sump (1) and the cycle repeats.

Lubrication  
Oil is drawn from a sump (1) in the crankcase and is pumped to the main oil gallery (2) by the oil pump (3) mounted in the front of the crankcase. The oil is then distributed through a network of passages (4) to the various bearings and components. The oil is then collected in the sump (1) and the cycle repeats.



## VALVE ROCKER CLEARANCE

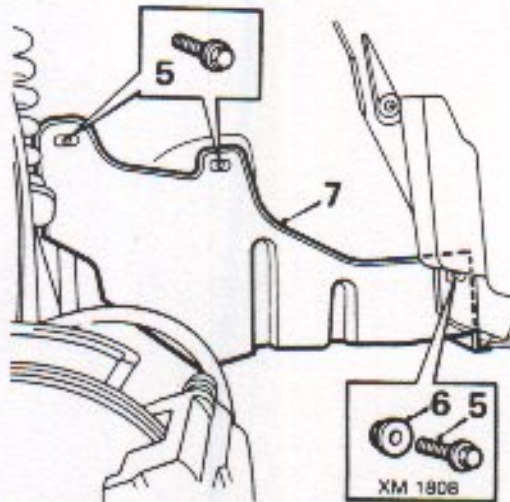
Service Repair No. 12.29.48

### Check and adjust

1. Remove rocker cover.
2. Remove rocker cover gasket.
3. Raise front of vehicle.

**WARNING: Support on safety stands.**

4. Remove R.H. front road wheel.



5. Remove 3 screws securing splash shield under R.H. front wing.
6. Remove spacer from front screw.
7. Remove splash shield.
8. Rotate crankshaft until valves of No. 4 cylinder are rocking.
9. Check and adjust inlet and exhaust valve rocker clearances on No. 1 cylinder to 0.30 mm.



10. Feeler gauge should be a sliding fit between rocker and valve stem.
11. Repeat operations 8 to 10 for remaining cylinders in the following order:  
 No. 2 cylinder valves rocking, adjust No. 3 cylinder rocker clearances.  
 No. 1 cylinder valves rocking, adjust No. 4 cylinder rocker clearances.  
 No. 3 cylinder valves rocking, adjust No. 2 cylinder rocker clearances.
12. Position splash shield.

13. Position spacer on front screw, fit and tighten screws securing shield.
14. Fit road wheel and tighten nuts to 110 Nm.
15. Fit rocker cover and gasket and tighten nuts to 9 Nm.
16. Remove stand(s) and lower vehicle.



## ENGINE SUMP GASKET

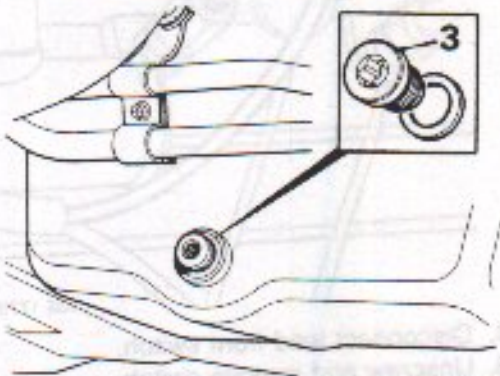
Service Repair No. 12.60.38

### Remove

1. Raise front of vehicle.

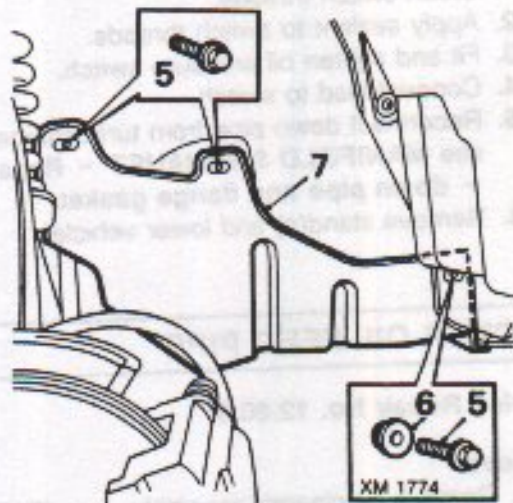
**WARNING: Support on safety stands.**

2. Place a container under sump.



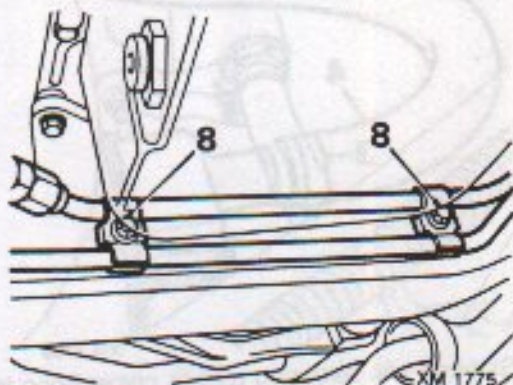
XM 1773A

3. Remove drain plug and sealing washer.
4. Allow oil to drain.



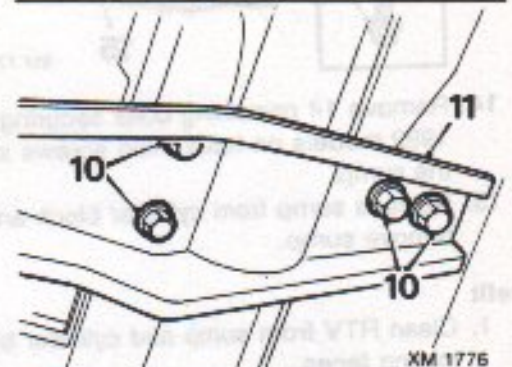
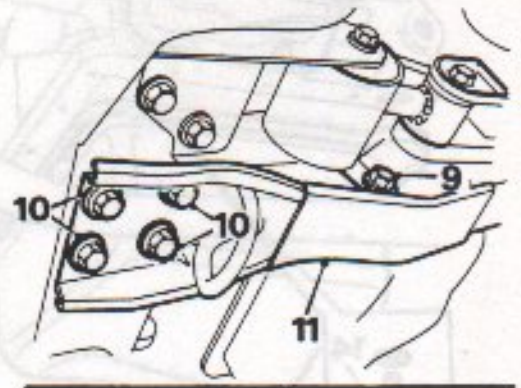
XM 1774

5. Remove 3 screws securing R.H. splash shield.
6. Remove spacer from front screw.
7. Remove shield.



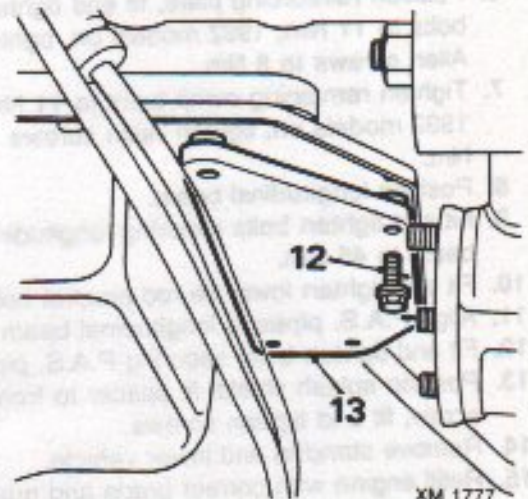
XM 1775

8. Remove 2 bolts securing P.A.S. pipes to longitudinal beam.



XM 1776

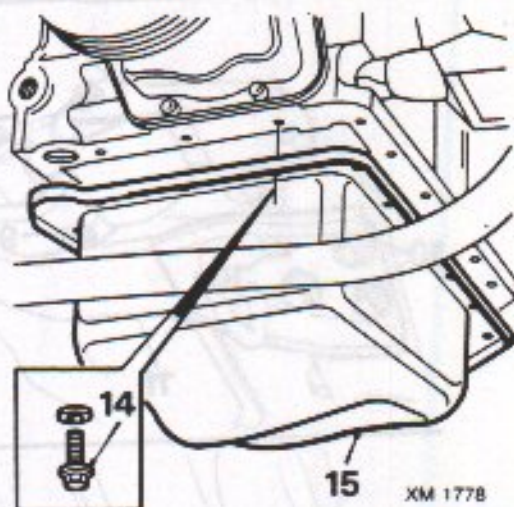
9. Remove bolt, lower tie rod bracket to longitudinal beam.
10. Remove 8 bolts securing longitudinal beam.
11. Remove longitudinal beam.



XM 1777

12. Remove 6 bolts securing reinforcing plate. 1992 models on have Allen screws securing the reinforcing plate.
13. Remove plate.

# ENGINE



14. Remove 14 remaining bolts securing sump. 1992 models on have Allen screws securing the sump.
15. Release sump from cylinder block and remove sump.

## Refit

1. Clean RTV from sump and cylinder block mating faces.
2. Clean inside of sump.
3. Clean reinforcing plate.
4. Apply RTV to sump joint face.
5. Position sump and fit bolts finger tight.
6. Position reinforcing plate, fit and tighten bolts to 11 Nm. 1992 models on, tighten Allen screws to 8 Nm.
7. Tighten remaining sump bolts to 11 Nm. 1992 models on, tighten Allen screws to 8 Nm.
8. Position longitudinal beam.
9. Fit and tighten bolts securing longitudinal beam to 45 Nm.
10. Fit and tighten lower tie rod bracket bolt.
11. Align P.A.S. pipes to longitudinal beam.
12. Fit and tighten bolts securing P.A.S. pipes.
13. Position splash shield, fit spacer to front screw, fit and tighten screws.
14. Remove stand(s) and lower vehicle.
15. Refill engine with correct grade and quantity of oil.

## OIL PRESSURE SWITCH

Service Repair No. 12.60.50

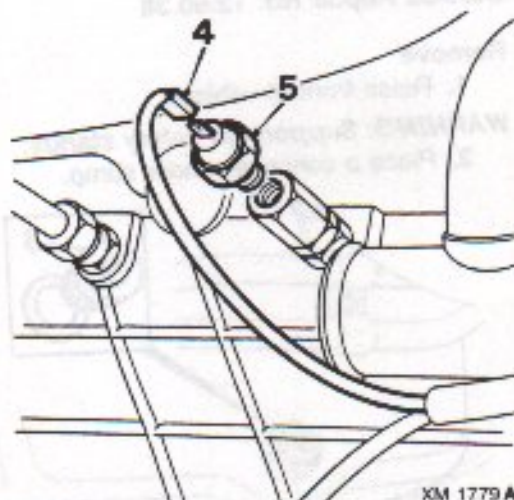
### Remove

1. Raise front of vehicle.

**WARNING: Support on safety stands.**

2. Disconnect down pipe from turbocharger, see **MANIFOLD & EXHAUST - Repairs - down pipe and flange gasket.**

3. Move pipe aside for access to oil pressure switch.



4. Disconnect lead from switch.
5. Unscrew and remove switch.

### Refit

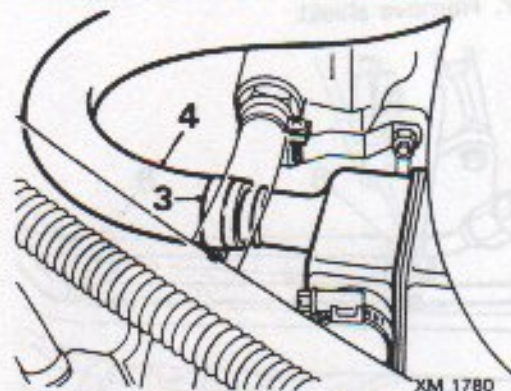
1. Clean switch threads.
2. Apply sealant to switch threads.
3. Fit and tighten oil pressure switch.
4. Connect lead to switch.
5. Reconnect down pipe from turbocharger, see **MANIFOLD & EXHAUST - Repairs - down pipe and flange gasket.**
6. Remove stand(s) and lower vehicle.

## ROCKER OIL FEED PIPE

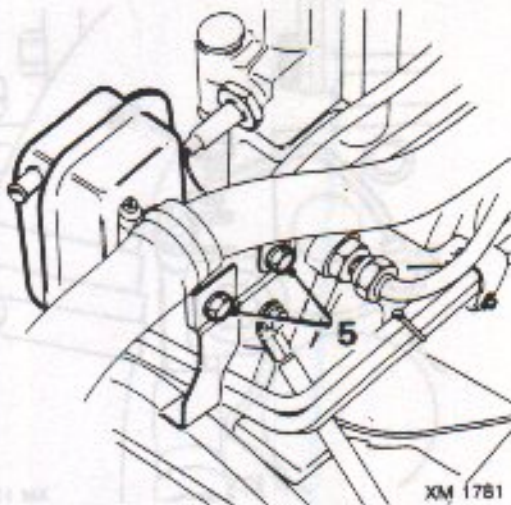
Service Repair No. 12.60.81

### Remove

1. Remove air cleaner assembly, see **FUEL SYSTEM - Repairs.**
2. Remove coolant manifold assembly, see **COOLING SYSTEM - Repairs.**



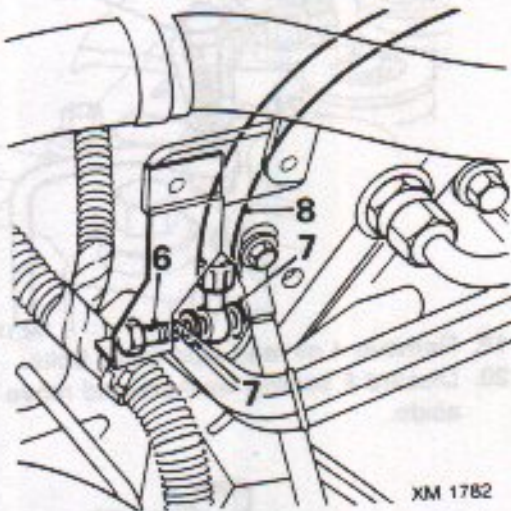
3. Slacken clip securing rocker cover hose to breather oil separator.
4. Disconnect hose from oil separator.



XM 1781

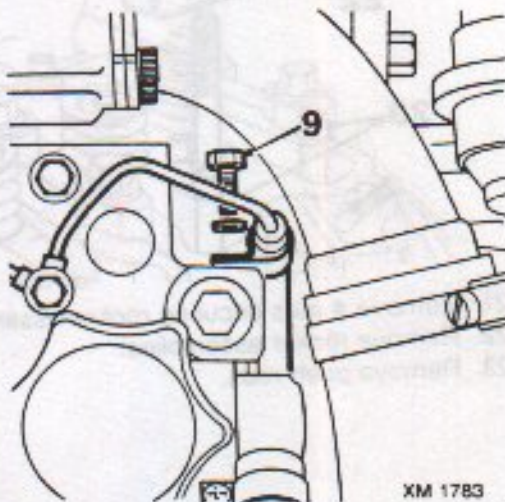
**Pre 1992 model illustrated.**

- Remove 2 bolts securing oil separator and move oil separator aside. 1992 models on have a circular oil separator.



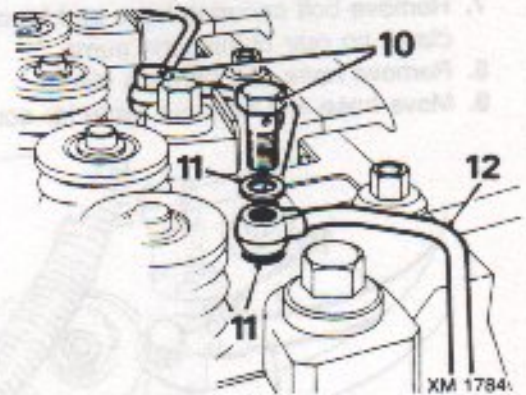
XM 1782

- Remove banjo bolt from rocker oil feed pipe hose union on cylinder block.
- Discard 2 banjo union sealing washers.
- Release hose.



XM 1783

- Remove screw securing hose clip to No 4 cylinder head end plate.



XM 1784

- Remove 4 pipe union banjo bolts from cylinder heads.
- Discard 8 banjo union sealing washers.
- Remove hose and pipe assembly.
- Remove clips from hose.

**Refit**

- Fit clips to hose.
- Position hose and pipe assembly.
- Position 8 new sealing washers, fit and tighten 4 banjo bolts in cylinder heads.
- Renew 2 hose banjo union sealing washers.
- Position 2 new sealing washers, fit and tighten banjo bolt in cylinder block.
- Align hose clip to No 4 cylinder head end plate, fit and tighten screw.
- Position breather oil separator.
- Align harness clip bracket and rocker oil feed hose clip.
- Fit and tighten 2 bolts securing breather separator.
- Connect breather hose and tighten hose clip.
- Fit coolant manifold assembly, see **COOLING SYSTEM - Repairs**.
- Fit air cleaner assembly, see **FUEL SYSTEM - Repairs**.
- Refill cooling system, see **COOLING SYSTEM - Adjustments**.

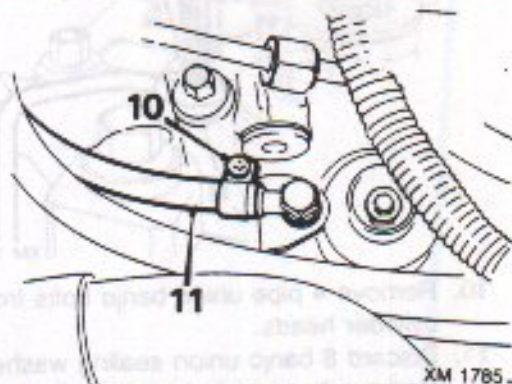
**CYLINDER HEAD GASKETS****Service Repair No. 12.29.01****Remove**

- Remove rocker cover assembly.
- Remove injectors, see **FUEL SYSTEM - Repairs**.
- Drain coolant, see **COOLING SYSTEM - Adjustments**.
- Remove coolant manifold, see **COOLING SYSTEM - Repairs**.
- Raise front of vehicle.

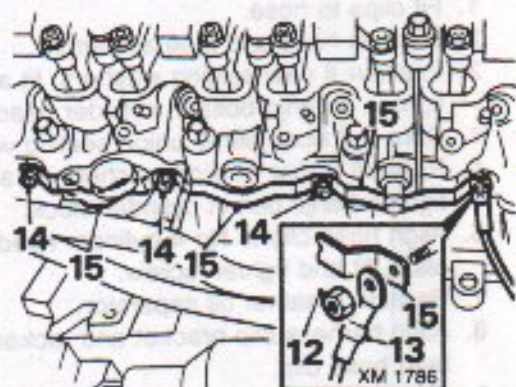
**WARNING: Support on safety stands.**

- Remove exhaust and inlet manifolds, see **MANIFOLD & EXHAUST - Repairs**.

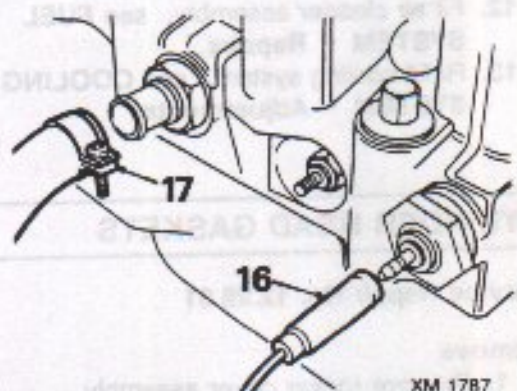
7. Remove bolt securing hose and harness clamp on rear of injection pump.
8. Remove hose and harness clamp.
9. Move hose and harness aside for access.



10. Slacken clip securing pressure sensing hose to injection pump.
11. Disconnect hose.

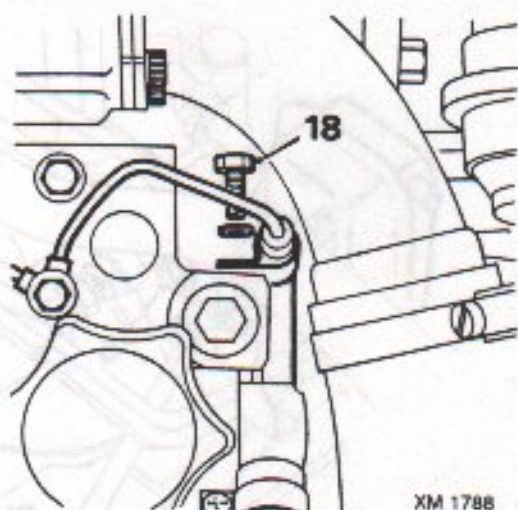


12. Remove No. 4 cylinder heater plug terminal nut.
13. Disconnect feed wire.
14. Remove remaining 3 terminal nuts.
15. Remove terminal links.

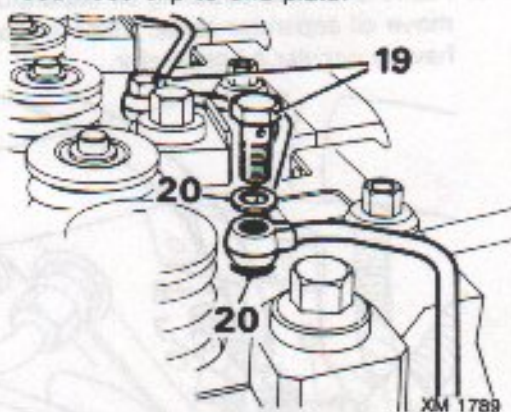


**Pre 1992 model illustrated**

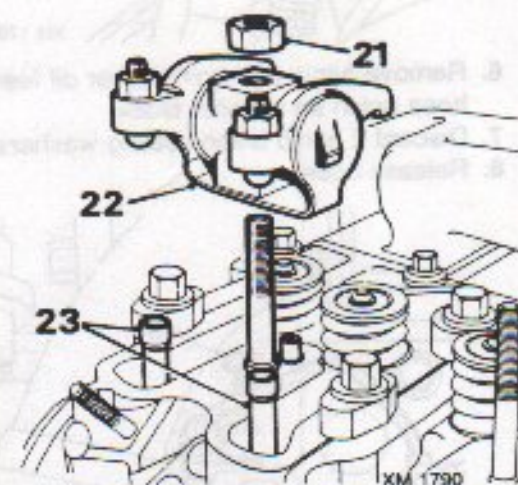
16. Disconnect lead from coolant temperature transmitter.
17. *Pre 1992 models:* Slacken clip securing injection pump cold start device hose to No. 3 cylinder head and disconnect hose.  
*1992 models on:* Disconnect lead from cold start advance temperature sensor.



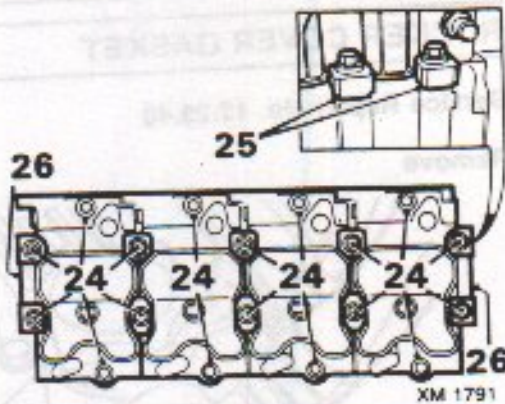
18. Remove screw securing cylinder head oil feed hose clip to end plate.



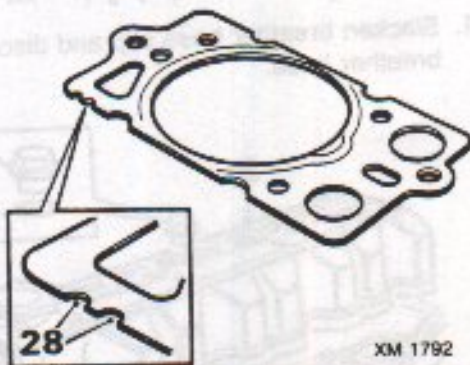
19. Remove 4 oil feed pipe banjo bolts.
20. Discard 8 sealing washers and move pipe aside.



21. Remove 4 nuts securing rocker assemblies.
22. Remove rocker assemblies.
23. Remove push rods.



24. Remove 18 bolts securing cylinder heads.
25. Remove 10 spacer blocks.
26. Remove 2 end plates.
27. Remove cylinder heads.



28. Remove cylinder head gaskets and note thickness indication which could be 2 notches, 1 notch or no notches in position shown.

**Note:** All 4 cylinder head gaskets should be same thickness.

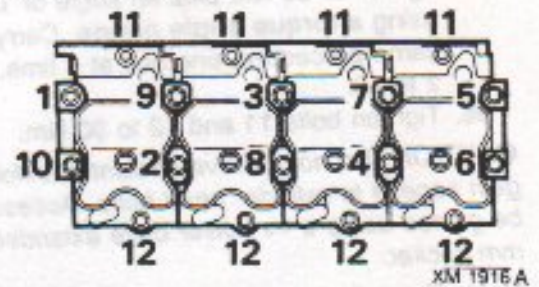
#### Refit

1. Clean cylinder head and block mating faces.
2. Clean cylinder head bolts, spacer blocks and end plates.
3. Clean remaining components and blow out oil feed drillings
4. Ensure new cylinder head gaskets have same thickness indication as those removed.  
If all were not the same on removal, ensure all are now of thickest type removed.  
**Cylinder head gasket compressed thickness:**  
No notch =  $1.42 \pm 0.04$  mm.  
2 notches =  $1.52 \pm 0.04$  mm.  
1 notch =  $1.62 \pm 0.04$  mm.
5. Position head gaskets.
6. Lubricate threads and beneath heads of cylinder head bolts 1 to 10 with Molybdenum Di Sulphide based grease. Lubricate threads of bolts 11 and 12 with engine oil.
7. Position cylinder heads one at a time, ensuring that the gasket is fully covered by

the cylinder head. Use a lead lamp to confirm full coverage. Fit and hand tighten bolts 11 and 12 prior to fitting the next head. When all heads are fitted, align cylinder head with exhaust manifold and recheck coverage of gasket.

**Note:** Using a straight-edge, check that the height of all heads is within 0.1 mm of each other. Using the shank of a 3 mm drill as a gauge, check that the gap between heads is 3 mm. The gap must not be below 1.5 mm or above 4.5 mm.

8. Position spacer blocks.
9. Position end plates.



10. Fit cylinder head bolts shown as 1 to 10 and tighten in that order to a torque of 30 Nm. Overcheck by repeating the procedure with the same torque.
11. Tighten bolts 1 to 10 in sequence a further 70° using a torque angle gauge. Again in sequence, tighten bolts 1 to 10 a further 70°.
12. Tighten bolts 11 first, then 12 to 80 Nm.
13. Refit manifolds leaving nuts loose, see **MANIFOLD & EXHAUST - Repairs**.
14. Lubricate and fit push rods.
15. Fit rocker assemblies, lubricate and tighten nuts to 108 Nm.
16. Clean cylinder head oil feed pipe union and sealing washers.
17. Position oil feed pipe, fit new sealing washers, fit and tighten banjo bolts.
18. Position hose clip to cylinder head end plate, fit and tighten screw.
19. Connect cold start device feed hose to cylinder head and tighten hose clip.
20. Connect temperature gauge transmitter lead.
21. Fit heater plug terminal links and connect feed wire.
22. Fit and tighten terminal nuts.
23. Connect pressure sensing hose to injection pump and tighten hose clip.
24. Position hose and harness, fit and tighten clamp bolt.
25. Tighten manifold nuts, see **MANIFOLD & EXHAUST - Repairs**.
26. Check and adjust valve rocker clearances, see **Adjustments**.
27. Fit splash shield.



28. Fit road wheel and tighten nuts to 110 Nm.
29. Remove stand(s) and lower vehicle.
30. Fit injectors, see **FUEL SYSTEM - Repairs.**
31. Fit coolant manifold, see **COOLING SYSTEM - Repairs.**
32. Fit rocker cover and tighten nuts to 9 Nm.
33. Refill cooling system, see **COOLING SYSTEM - Adjustments.**
34. Run engine for 20 minutes, until it reaches stabilised operating temperature, then allow the engine to cool for a minimum of 4 hours. Where possible, allow an overnight cool.
35. Starting at bolt 1, slacken completely then, tighten to 30 Nm plus an angle of 120°, using a **torque angle gauge**. Carry out same procedure, one bolt at a time, for bolts 2 to 10.
36. Tighten bolts 11 and 12 to 90 Nm.

**CAUTION:** Do not remove coolant manifold to gain access to cylinder head bolts. Access can be gained using a  $\frac{3}{8}$ " power drive extended 11 mm socket.

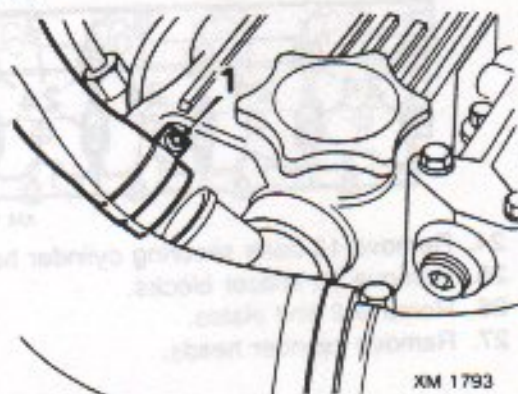
**Note:** The cylinder head bolts must be retorqued in the correct sequence at 24,000 miles (40,000 Km) after engine rebuild as follows:

Tighten bolts 1 to 10 a further 10° - 15°.  
Check that torque of bolts 11 and 12 is still 90 Nm.

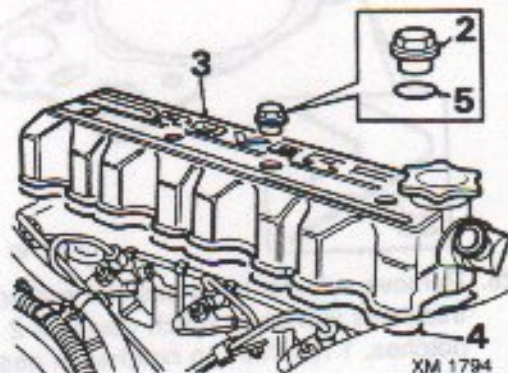
## ROCKER COVER GASKET

Service Repair No. 12.29.40

### Remove



1. Slacken breather hose clip and disconnect breather hose.



2. Remove 4 nuts securing rocker cover.
3. Remove rocker cover.
4. Remove rocker cover gasket.
5. Remove 'O' rings from nuts.

### Refit

1. Clean rocker cover nuts, lubricate 'O' rings and fit seals to nuts.
2. Clean rocker cover and cylinder heads mating faces.
3. Fit rocker cover gasket.
4. Fit and align rocker cover.
5. Fit and tighten rocker cover nuts to 9 Nm.
6. Connect breather hose, tighten hose clip.



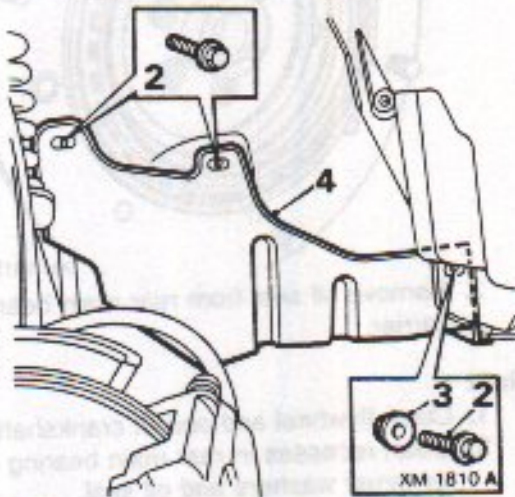
## OIL FILTER HEAD SEAL

Service Repair No. 12.60.03

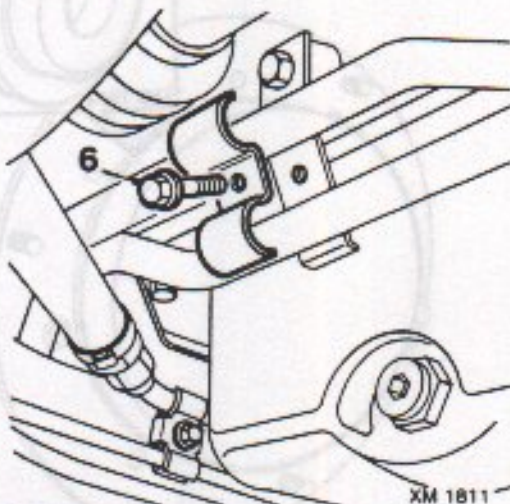
### Remove

1. Raise front of vehicle.

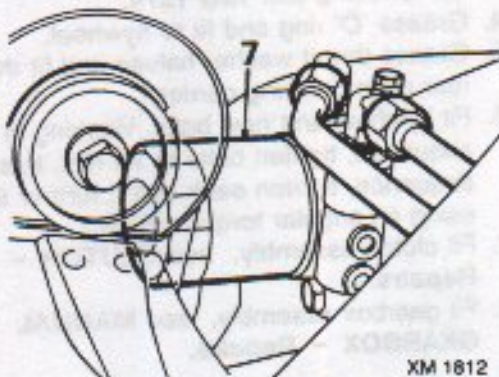
**WARNING:** Support on safety stands.



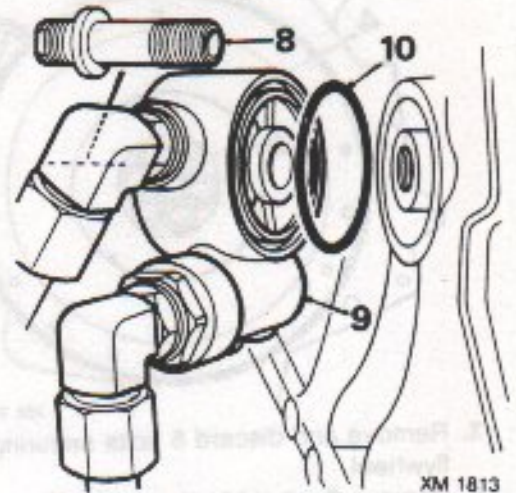
2. Remove 3 screws securing splash shield under R.H. front wing.
3. Remove spacer from front screw.
4. Release splash shield from body.
5. Remove splash shield.



6. Remove screw securing oil cooler pipe clamp to bracket on cylinder block.



7. Unscrew oil filter cartridge from filter head.



8. Remove filter head union.
9. Release filter head from cylinder block.
10. Remove filter head sealing ring.

### Refit

1. Clean filter head and cylinder block mating faces.
2. Clean seal recess.
3. Apply grease to seal recess and fit seal to filter head.
4. Align filter head to cylinder block.
5. Fit and tighten filter head union to 37 Nm.
6. Fit filter cartridge hand tight.
7. Align oil cooler pipes to bracket, position clamp, fit and tighten clamp screw.
8. Position splash shield.
9. Position spacer on front screw, fit and tighten screws securing shield.
10. Remove stand(s) and lower vehicle.

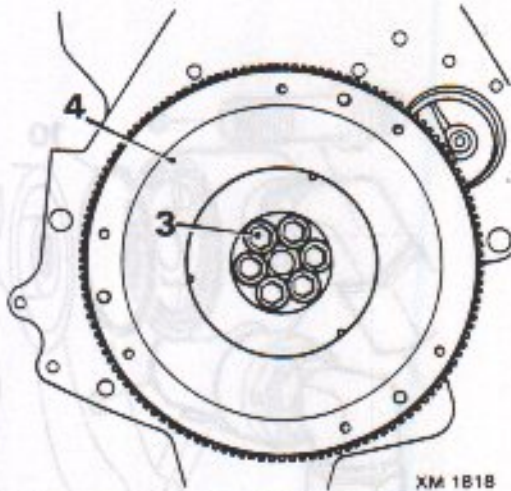
## FLYWHEEL AND CRANKSHAFT REAR OIL SEAL

Service Repair No. Flywheel - 12.53.07

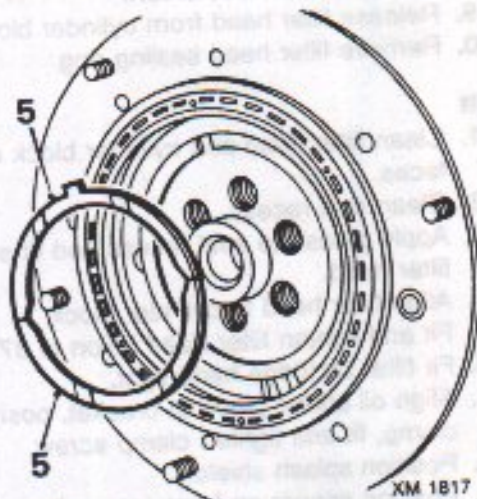
Service Repair No. Crankshaft rear oil seal - 12.21.20

### Remove

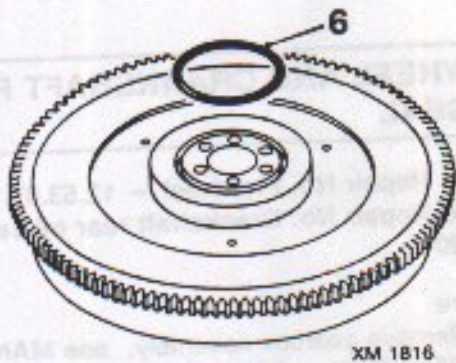
1. Remove gearbox assembly, see **MANUAL GEARBOX - Repairs**.
2. Remove clutch assembly, see **CLUTCH - Repairs**.



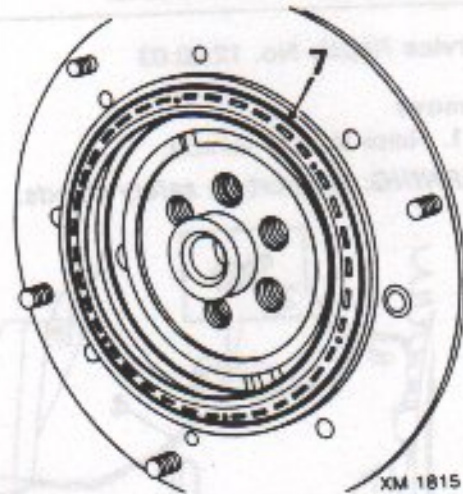
3. Remove and discard 6 bolts securing flywheel.
4. Remove flywheel from crankshaft.



5. Remove 2 half thrust washers from rear main bearing carrier.



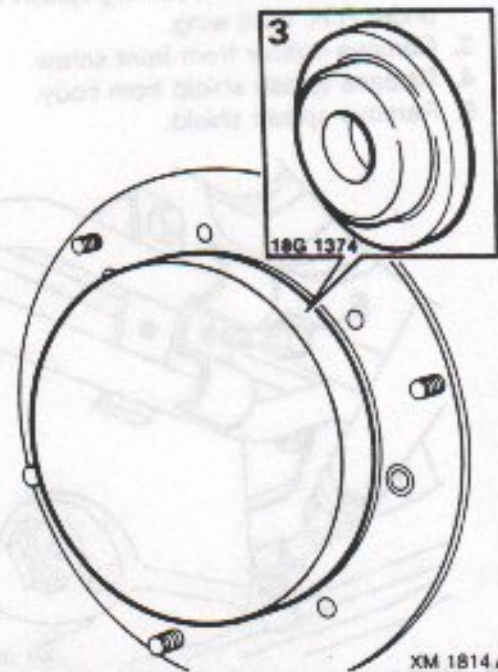
6. Remove 'O' ring from flywheel.



7. Remove oil seal from rear main bearing carrier.

### Refit

1. Clean flywheel and end of crankshaft.
2. Clean recesses in rear main bearing carrier for thrust washers and oil seal.



3. Lubricate oil seal and fit to rear main bearing carrier using tool 18G 1374.
4. Grease 'O' ring and fit to flywheel.
5. Grease thrust washer halves and fit them to rear main bearing carrier.
6. Fit flywheel and new bolts. Working in sequence, tighten bolts to 20 Nm. In same sequence, tighten each bolt a further 60° using an angular torque gauge.
7. Fit clutch assembly, see **CLUTCH - Repairs**.
8. Fit gearbox assembly, see **MANUAL GEARBOX - Repairs**.



## CRANKSHAFT FRONT OIL SEAL

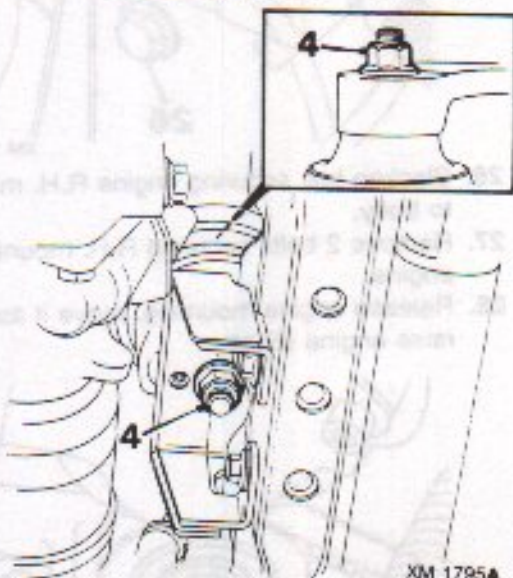
Service Repair No. 12.21.14

### Remove

1. Raise front of vehicle.

**WARNING: Support on safety stands.**

2. Remove R.H. drive shaft, see **DRIVE SHAFTS - Repairs.**
3. Remove exhaust front pipe, see **MANIFOLD & EXHAUST - Repairs.**

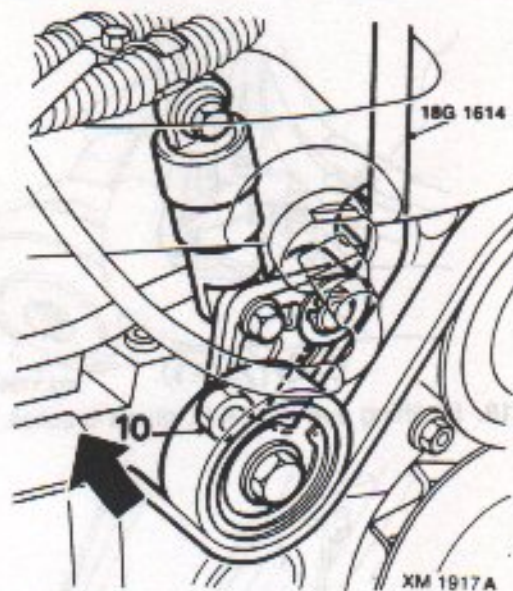


4. Remove 2 nuts securing rear centre engine mounting to mounting brackets on crossmember and engine.
5. Position trolley jack under power unit.
6. Support power unit under differential housing using trolley jack.

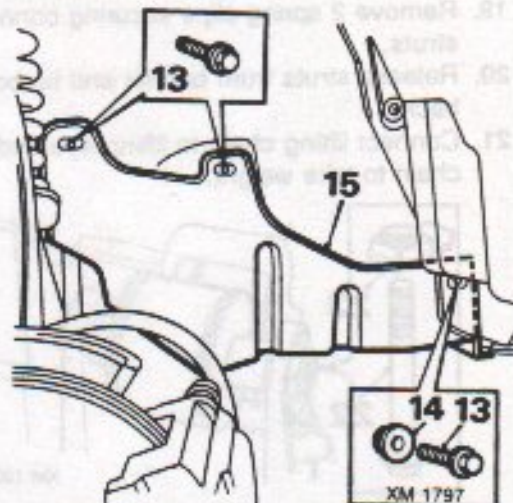
**CAUTION:** Use a block of wood or hard rubber to protect the differential housing. Never support the engine using the sump.



7. Remove 3 bolts and 'Torx' screw securing rear mounting bracket to engine.
8. Release mounting and bracket assembly, remove mounting from bracket and remove mounting bracket.

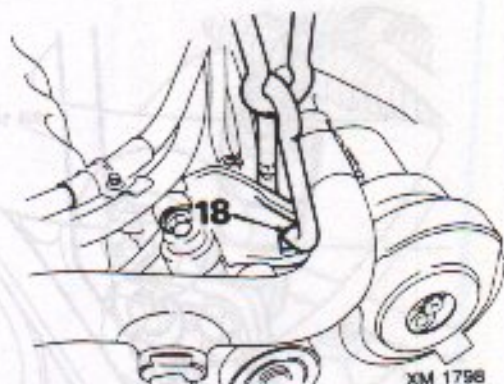


9. Fit tool 18G 1614 to power steering pump bracket and raise tensioner.
10. Slacken nut on tensioner pulley eccentric and rotate pulley to high position.
11. Release belt from under tensioner and release tensioner.
12. Remove tool 18G 1614.

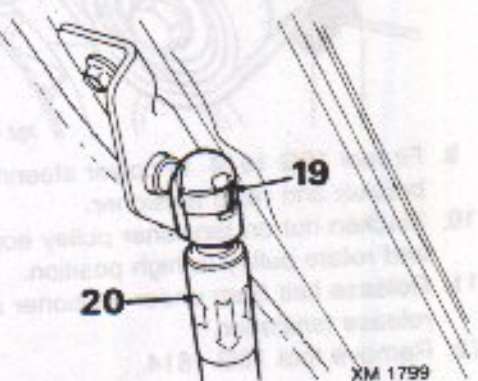


13. Remove 3 screws securing splash shield under R.H. front wing.
14. Remove spacer from front screw.
15. Remove splash shield.
16. Release belt from pulleys.
17. Release belt from between crankshaft pulley and longitudinal member.

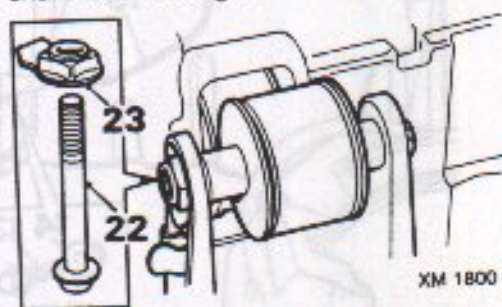
# ENGINE



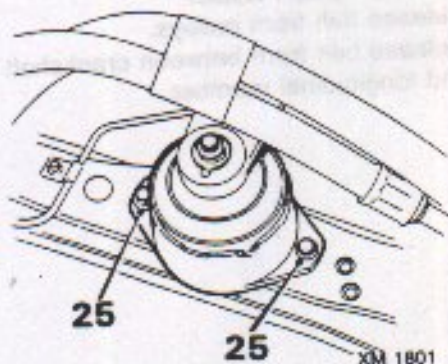
18. Fit lifting eye to P.A.S. pump bracket.



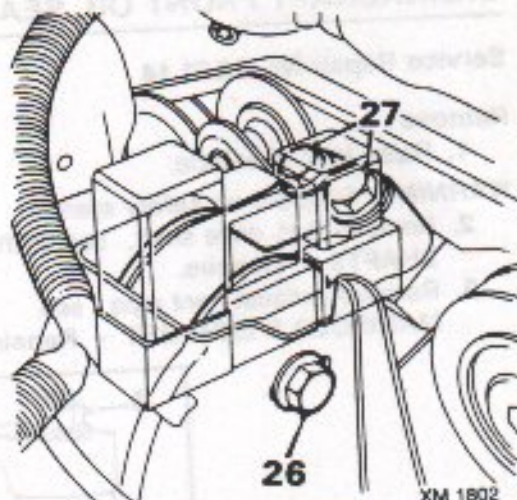
19. Remove 2 spring clips securing bonnet struts.
20. Release struts from bonnet and tie bonnet back.
21. Connect lifting chain to lifting eye and raise chain to take weight.



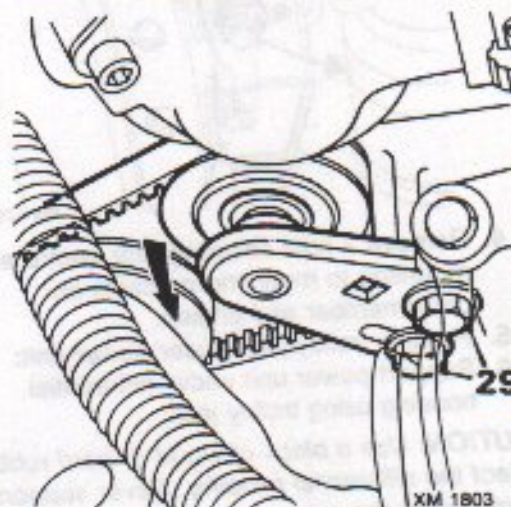
22. Remove engine rear tie bar through - bolt.
23. Remove special nut.
24. Remove engine lower tie bar through - bolt.



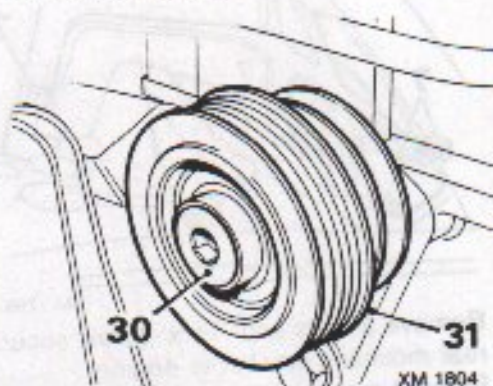
25. Remove 2 bolts securing engine front mounting to crossmember.



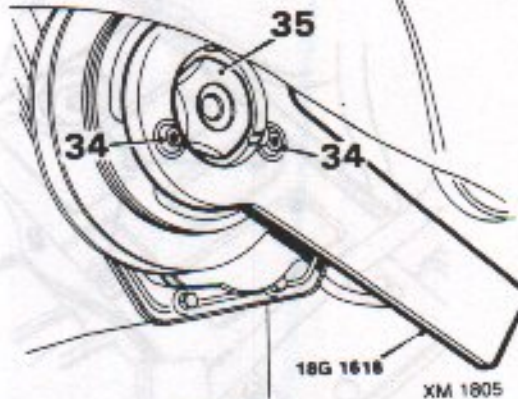
26. Slacken bolt securing engine R.H. mounting to body.
27. Remove 2 bolts securing R.H. mounting to engine.
28. Release engine mounting, move it aside and raise engine slightly.



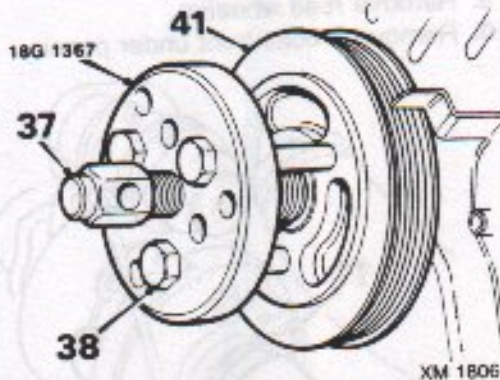
29. Slacken 2 bolts, coolant pump drive belt tensioning pulley, to release coolant pump drive belt tension.



30. Remove Allen screw securing coolant pump drive pulley.
31. Remove pulley.
32. Lower jack.
33. Move power unit back towards bulkhead and lower power unit.



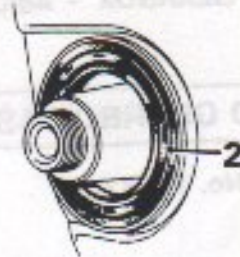
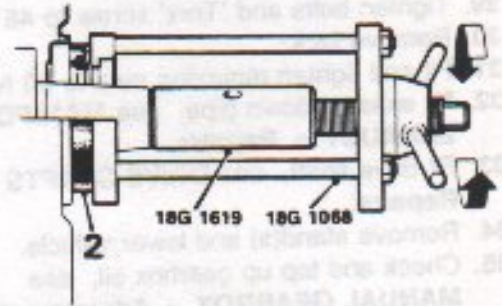
34. Position tool 18G 1618 to crankshaft pulley and secure with 3 bolts.
35. Remove crankshaft pulley nut.
36. Remove tool 18G 1618.



37. Slacken centre screw on tool 18G 1367.
38. Position tool 18G 1367 to crankshaft pulley and fit and tighten 3 bolts.
39. Tighten centre screw on tool 18G 1367 to release crankshaft pulley.
40. Remove tool 18G 1367.
41. Remove pulley.
42. Warm area around seal using an hot air gun and carefully lever out seal.

#### Refit

1. Clean seal recess and lubricate new seal.



XM 1807

2. Fit seal, using tools 18G 1068 and 18G 1619.
3. Clean pulley and crankshaft and fit pulley.
4. Apply Loctite 601 to pulley nut thread and fit pulley nut.
5. Position tool 18G 1618 to pulley and secure with 3 bolts.
6. Tighten pulley nut to 177 Nm.
7. Remove tool 18G 1618.
8. Raise power unit.
9. Fit coolant pump drive pulley, fit and tighten Allen screw.
10. Retension coolant pump drive belt, see **COOLING SYSTEM - Adjustments**.
11. Position engine R.H. mounting.
12. Fit and tighten 2 bolts to 75 Nm.
13. Tighten through - bolt securing mounting to body to 45 Nm.
14. Align engine front mounting.
15. Fit and tighten 2 bolts to 45 Nm.
16. Align engine lower tie bar, fit and tighten through - bolt to 45 Nm..
17. Raise jack.
18. Align engine top tie bar. position special nut, fit and tighten through - bolt to 45 Nm.
19. Lower engine and disconnect chain from lifting eye.
20. Untie bonnet, connect bonnet struts and fit spring clips.
21. Remove lifting eye from P.A.S. pump bracket.
22. Clean belt pulleys and fit belt to pulleys.
23. Fit tool 18G 1614 to P.A.S. pump bracket, fit drive belt and adjust belt tension, see **ELECTRICAL - Adjustments**.
24. Remove tool 18G 1614.
25. Position splash shield, position spacer to front screw, fit and tighten screws.
26. Position engine rear centre mounting and mounting bracket, fit mounting to bracket.
27. Align mounting to crossmember and bracket to cylinder block.

# ENGINE

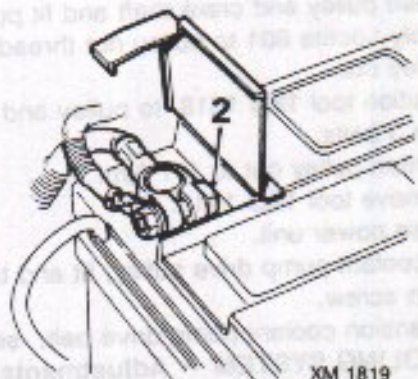
28. Fit bolts and 'Torx' screw.
29. Tighten bolts and 'Torx' screw to 45 Nm.
30. Remove jack.
31. Fit and tighten mounting nuts to 90 Nm.
32. Fit exhaust down pipe, see **MANIFOLD & EXHAUST - Repairs.**
33. Fit drive shaft, see **DRIVE SHAFTS - Repairs.**
34. Remove stand(s) and lower vehicle.
35. Check and top up gearbox oil, see **MANUAL GEARBOX - Adjustments.**

## ENGINE AND GEARBOX ASSEMBLY

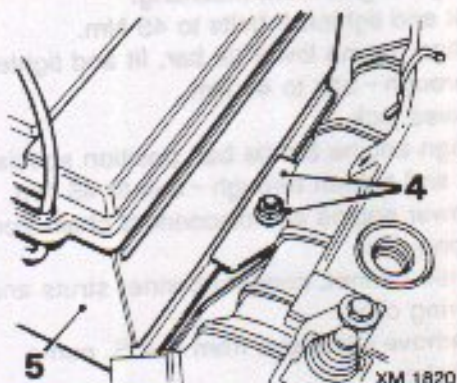
Service Repair No. 12.37.01

### Remove

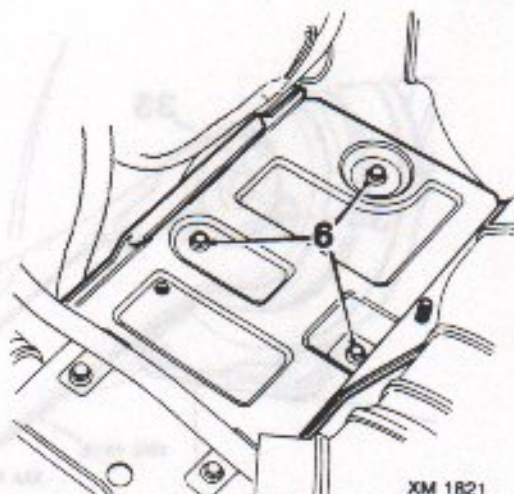
1. Remove air cleaner assembly, see **FUEL SYSTEM - Repairs.**



2. Disconnect battery earth lead. Release battery positive terminal cover and remove battery positive lead clamp screw.
3. Disconnect positive leads from battery.



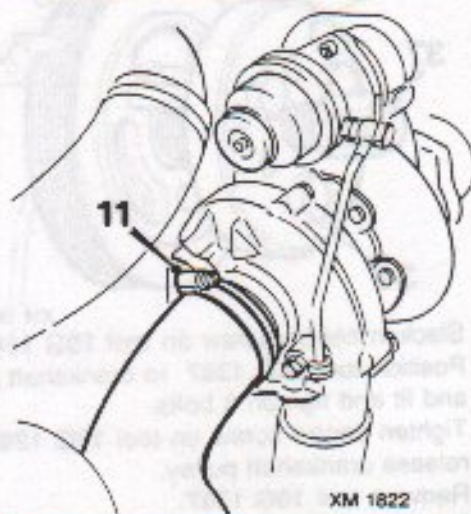
4. Remove nut securing battery clamp, remove clamp.
5. Remove battery.



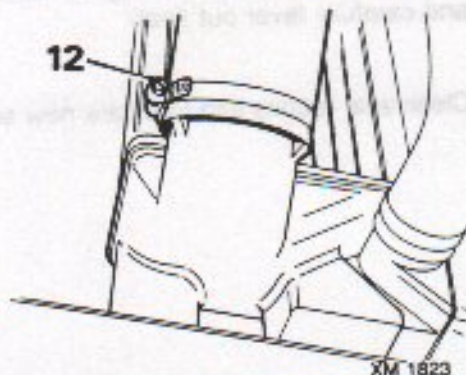
6. Remove 3 bolts securing battery tray.
7. Remove battery tray.
8. Raise front of vehicle.

**WARNING: Support on safety stands.**

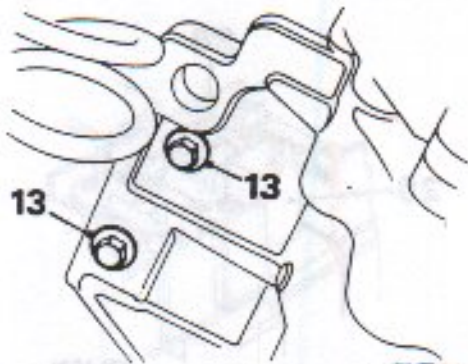
9. Remove road wheel(s).
10. Remove 5 bolts front under panel.



11. Remove clip securing hose to turbocharger.

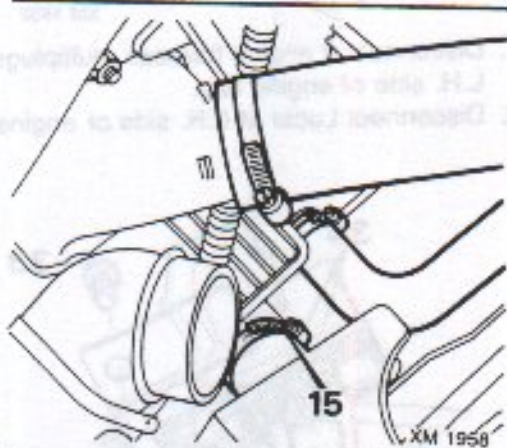
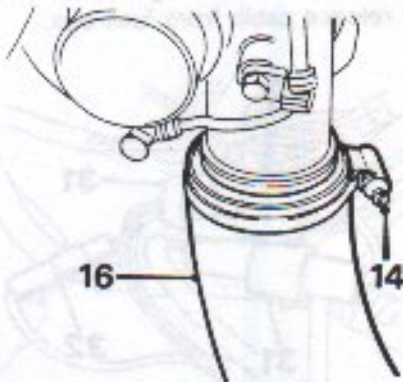


12. Remove clip securing hose to intercooler.



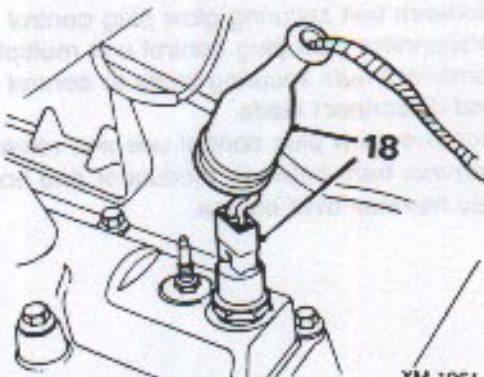
XM TB24

13. Remove 2 bolts securing hose connector to gearbox case.



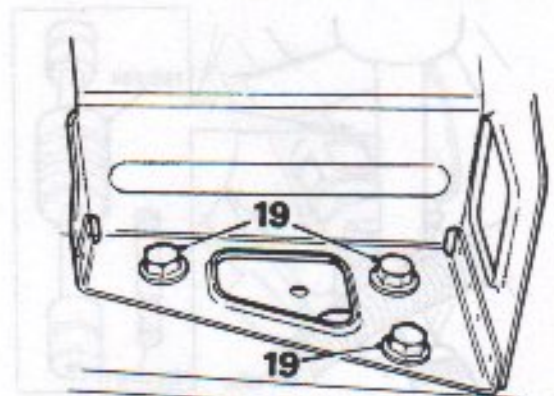
XM 1958

14. Disconnect hose from turbocharger.  
15. Disconnect hose from intercooler.  
16. Remove hose and connector pipe assembly.  
17. Plug turbocharger and intercooler.



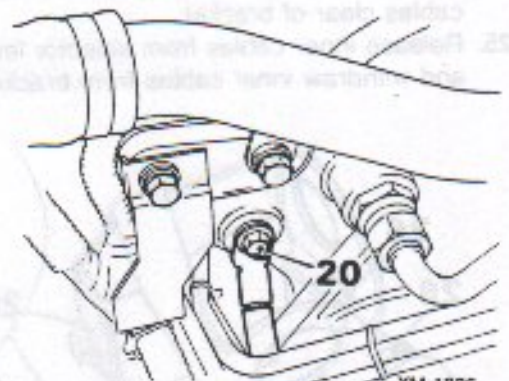
XM 1961

18. Release reverse lamp switch cover and disconnect multiplug.



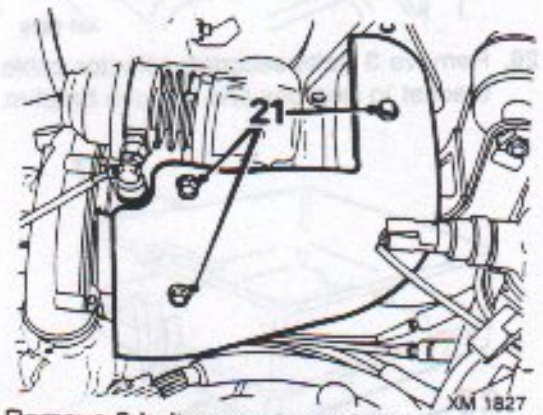
XM 1825

19. Remove 3 bolts securing air cleaner bracket, remove bracket.



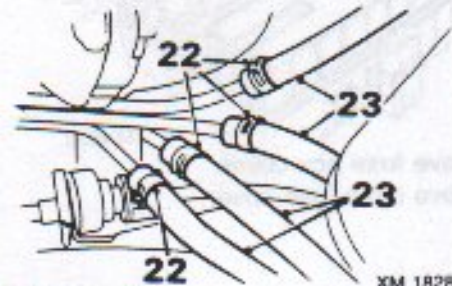
XM 1826

20. Remove bolt securing earth lead to engine backplate and move lead aside.



XM 1827

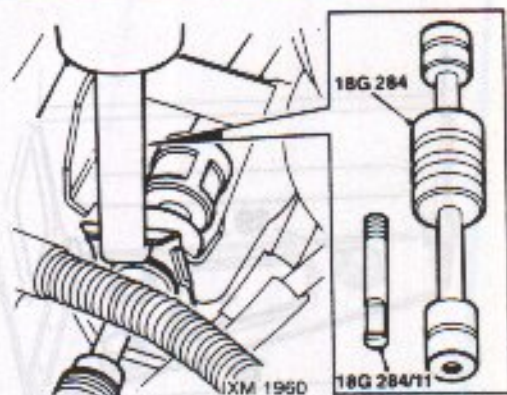
21. Remove 3 bolts securing turbocharger heatshield and remove heatshield.



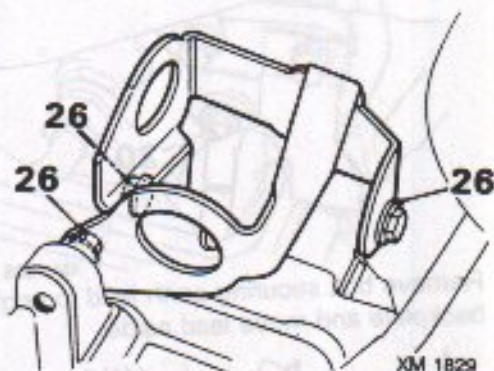
XM 1828

22. Release 4 clips securing fuel hoses to pipes.  
23. Disconnect and plug hoses.

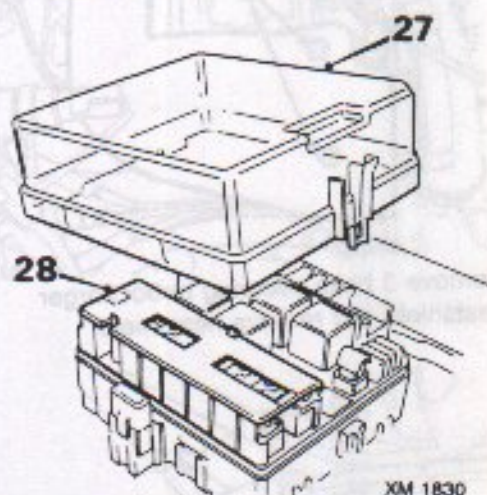




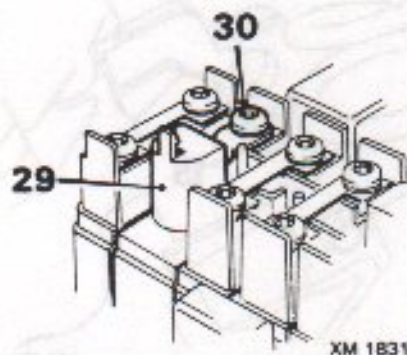
24. Using tools **18G 284** and **18G 284 - 11**, remove clips securing gear selector outer cables in bracket. Pull outer cables clear of bracket.
25. Release inner cables from selector levers and withdraw inner cables from bracket.



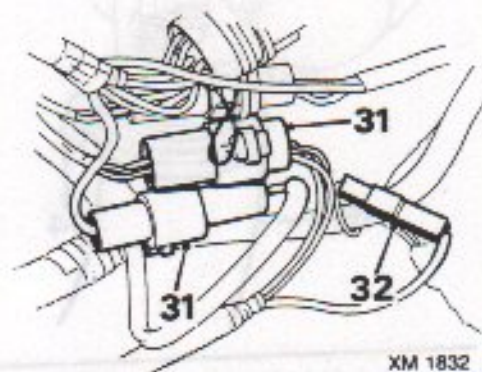
26. Remove 3 bolts securing selector cable bracket to gearbox and remove bracket.



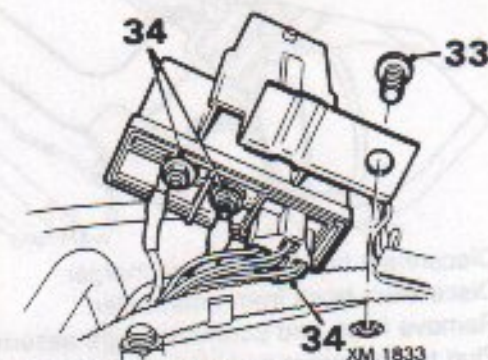
27. Remove fuse box cover.
28. Remove main fuse cover.



29. Remove main feed cable cover.
30. Remove screw securing main feed cable and release cable from fuse box.

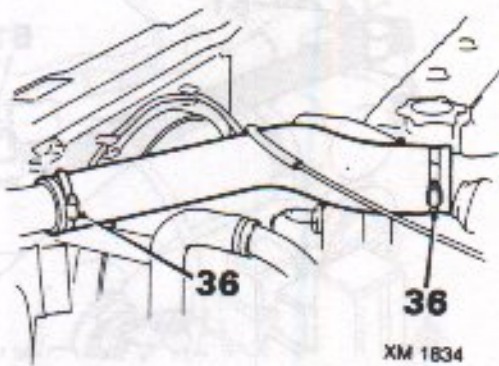


31. Disconnect 2 engine harness multiplugs at L.H. side of engine bay.
32. Disconnect Lucar at L.H. side of engine bay.



### Models fitted with ABS

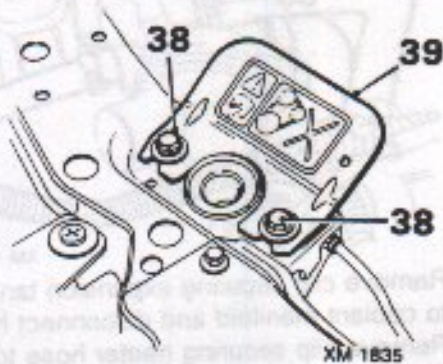
33. Remove bolt securing glow plug control unit.
34. Disconnect glow plug control unit multiplug, remove 2 nuts securing leads to control unit and disconnect leads. Remove glow plug control unit and release harness from between modulator and body.
35. Lay harness over engine.



XM 1834

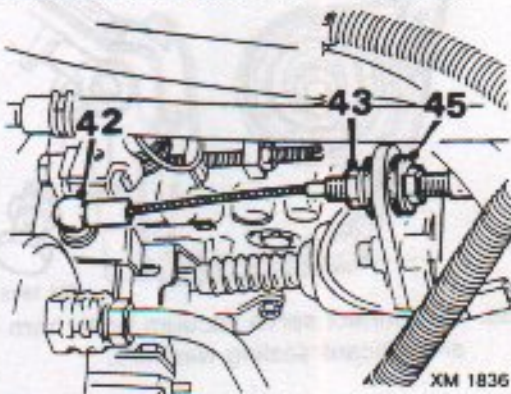
**All Models**

36. Slacken 2 intake hose clips, disconnect hose from intake elbow and remove hose from intercooler.
37. Plug intercooler and intake elbow.



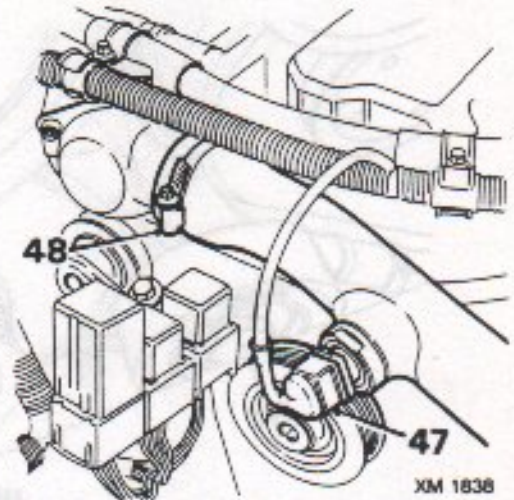
XM 1835

38. Slacken 2 bolts securing bonnet R.H. catch.
39. Remove warning label plate.
40. Position drain tin and drain coolant, see **COOLING SYSTEM - Adjustments.**
41. Remove radiator, fan and cowl assembly, see **COOLING SYSTEM - Repairs.**



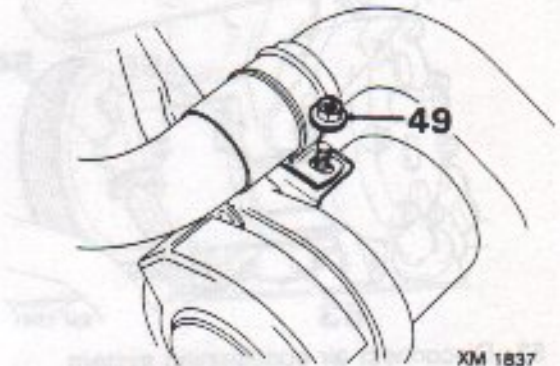
XM 1836

42. Release throttle inner cable pivot from lever on pump.
43. Unscrew cable locknut.
44. Release inner cable from abutment bracket.
45. Release cable sleeve from abutment bracket grommet and release grommet from abutment bracket.
46. Release cable from abutment and move cable assembly aside.



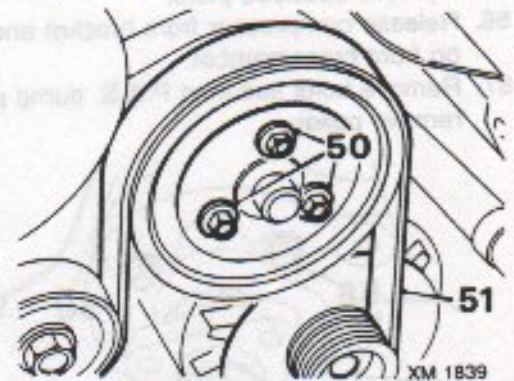
XM 1838

47. Disconnect overheated switch multiplug.
48. Slacken clip securing top hose to thermostat housing.



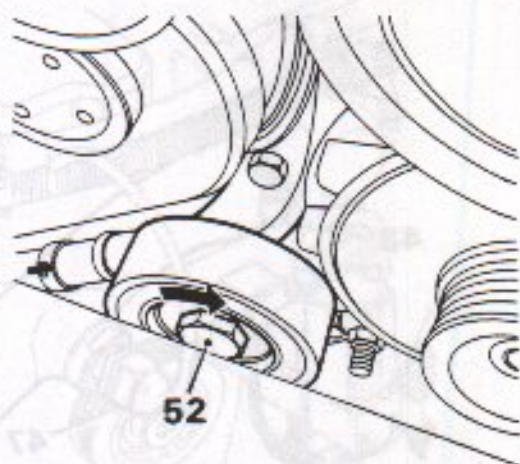
XM 1837

49. Remove nut securing top hose clip to P.A.S. pump bracket, remove top hose.



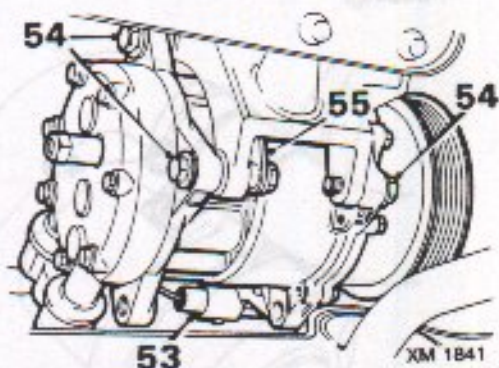
XM 1839

50. Slacken 3 P.A.S. pump drive pulley bolts.
51. Remove auxiliary drive belt.



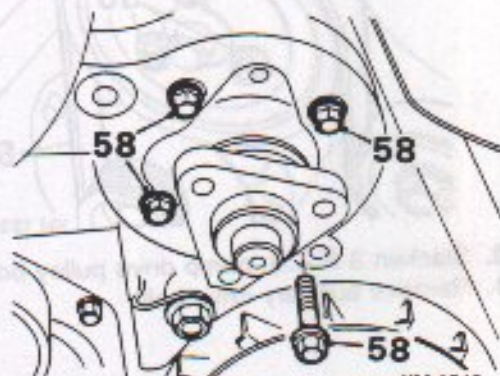
XM 1840

52. Remove lower jockey wheel centre bolt (L.H. thread) and remove jockey wheel.



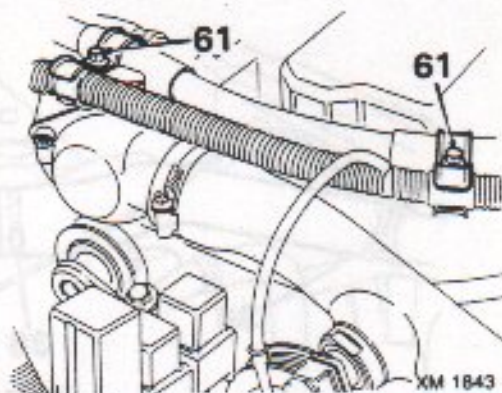
XM 1841

53. Disconnect air conditioning system compressor lead.  
 54. Remove 4 bolts securing compressor.  
 55. Remove threaded plate.  
 56. Release compressor from bracket and lay on front crossmember.  
 57. Remove bolts securing P.A.S. pump pulley, remove pulley.



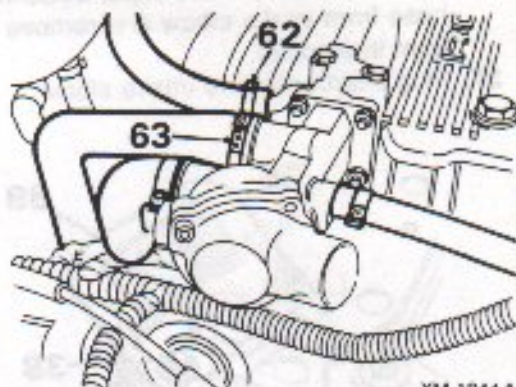
XM 1842

58. Remove 4 bolts securing P.A.S. pump.  
 59. Release pump reservoir from clip.  
 60. Release pump from bracket and tie pump aside.



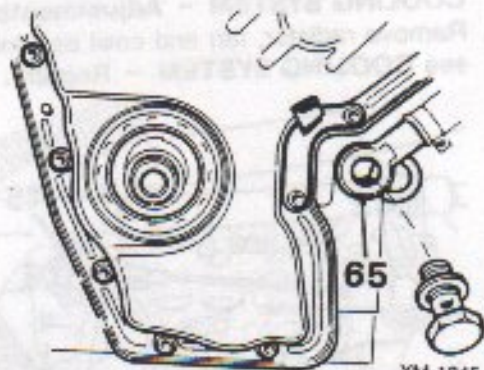
XM 1843

61. Remove 2 screws securing hose and harness clamps, remove clamps.



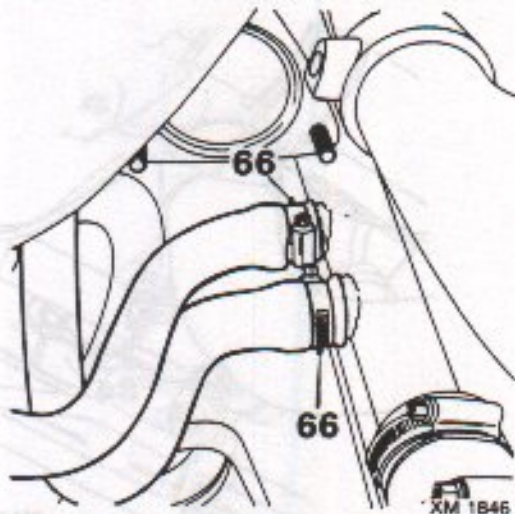
XM 1844 A

62. Remove clip securing expansion tank hose to coolant manifold and disconnect hose.  
 63. Remove clip securing heater hose to thermostat housing and disconnect hose.  
 64. Remove exhaust front pipe, see **MANIFOLD & EXHAUST - Repairs.**

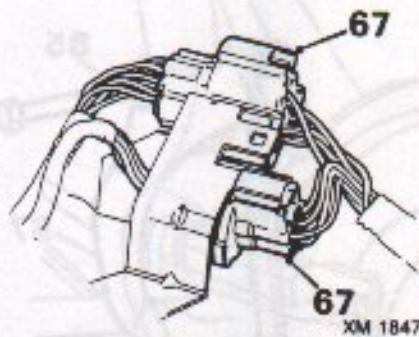


XM 1845

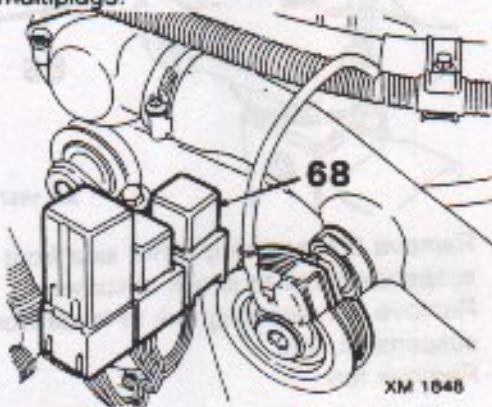
65. Disconnect servo vacuum hose from engine and discard sealing washers.



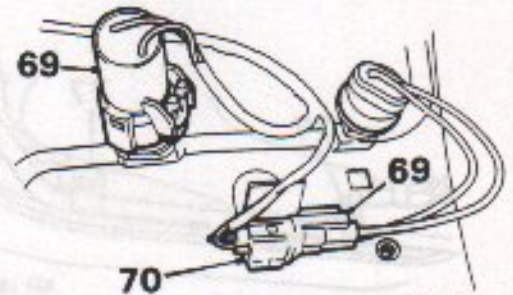
66. Remove 2 clips securing hoses to coolant pipe on rear of engine and disconnect 2 hoses.



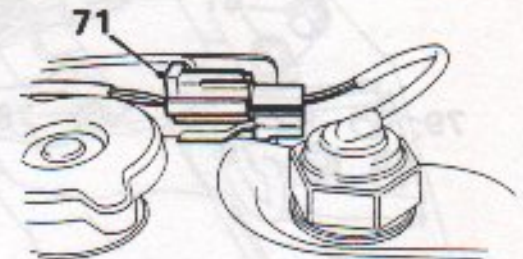
67. Release 2 engine harness multiplugs from bracket on R.H. inner wing and disconnect multiplugs.



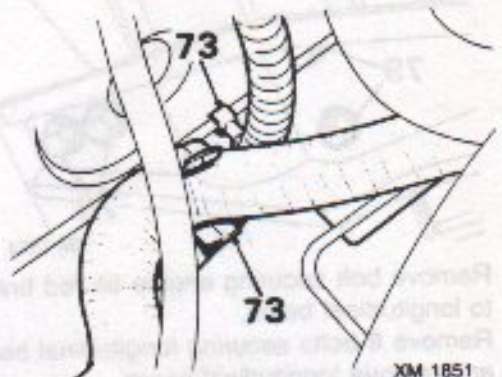
68. Release 3 relays from bracket.



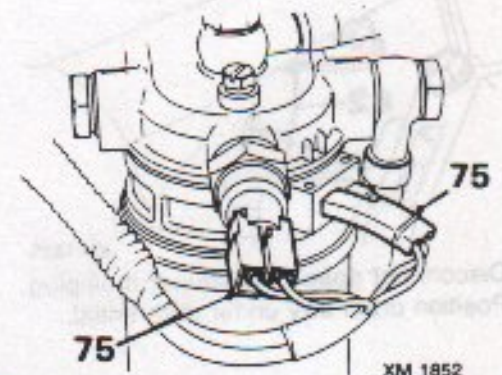
69. Disconnect air conditioning system dual and low pressure switch leads.  
70. Release air conditioning system multiplug from bracket on R.H. inner wing panel and disconnect multiplug.



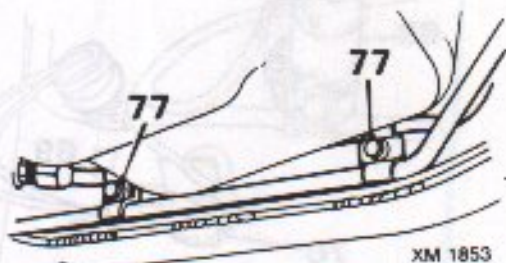
71. Disconnect low coolant level sensor multiplug.  
72. Remove 2 screws securing expansion tank.



73. Release 2 overflow hose clips from brake pipe.  
74. Remove expansion tank and hose assembly.



75. Disconnect fuel heater and switch leads.  
76. Release harness from behind filter and lay harness over engine.



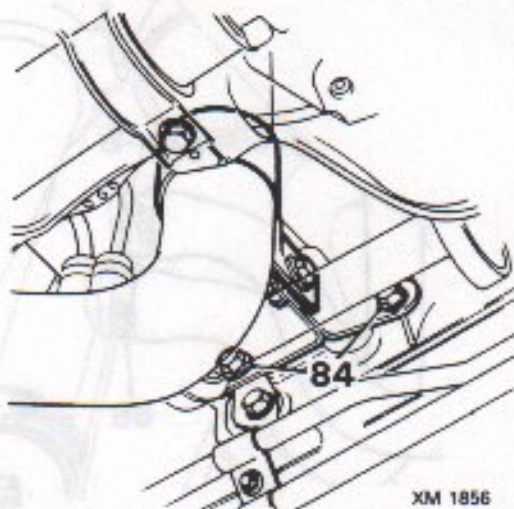
77. Remove 2 bolts securing P.A.S. pipes to longitudinal beam.



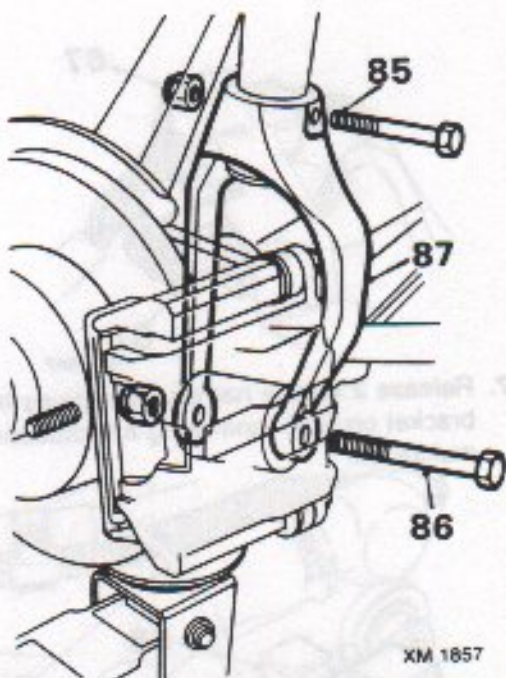
78. Remove bolt securing engine tie rod bracket to longitudinal beam.  
 79. Remove 8 bolts securing longitudinal beam and remove longitudinal beam.  
 80. Remove tie rod through - bolt.  
 81. Remove 2 bolts securing tie rod bracket, remove bracket and tie rod assembly.



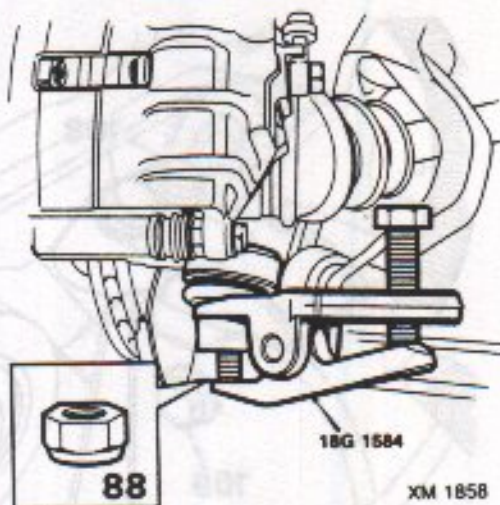
82. Disconnect speed transducer multiplug.  
 83. Position drain tray under differential.



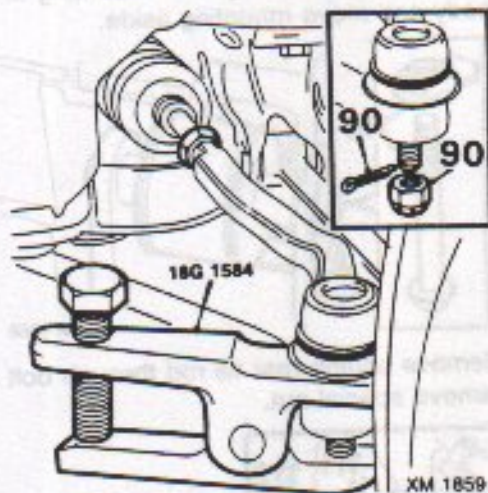
84. Remove 2 bolts securing exhaust front pipe bracket to cylinder block and remove bracket.



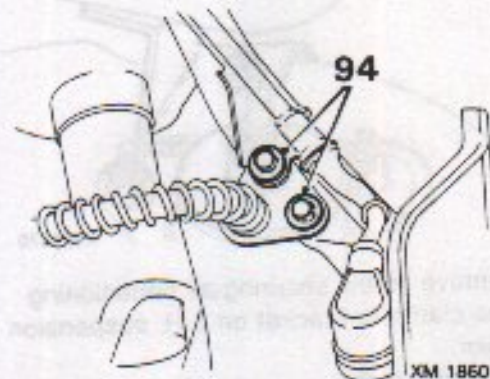
85. Remove bolt securing either side front suspension fork to shock absorber.  
 86. Remove bolt securing fork to lower front suspension arm.  
 87. Remove fork.



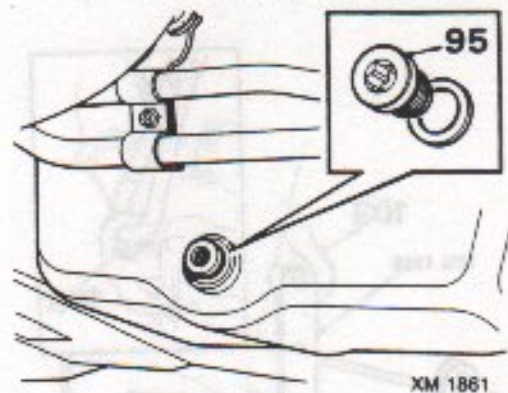
88. Remove bottom ball joint nut.  
89. Release ball joint from lower arm, using tool 18G 1584.



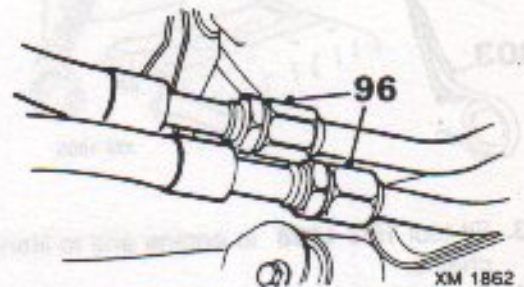
90. Remove split pin and nut from steering track rod ball joint.  
91. Release ball joint from steering arm, using tool 18G 1584.  
92. Release drive shaft from differential.  
93. Repeat operations 85 to 92 to release second drive shaft from differential.



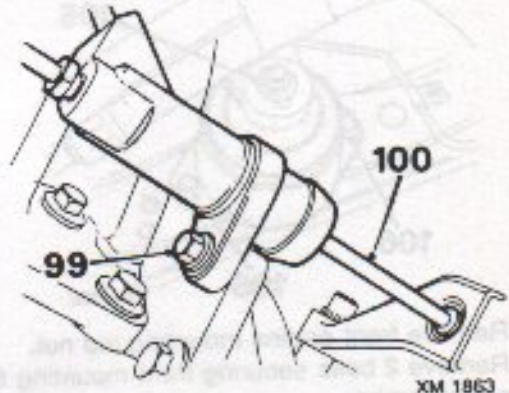
94. Remove 2 bolts securing brake hose bracket to suspension.



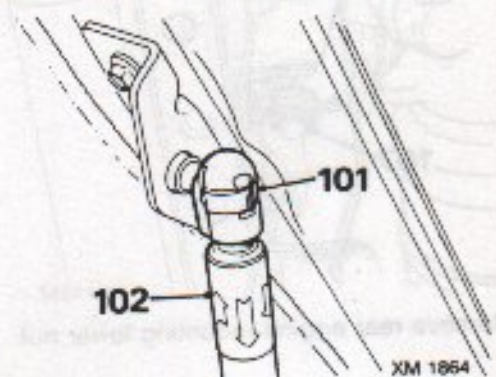
95. Position drain tray under sump, remove sump drain plug and drain sump.



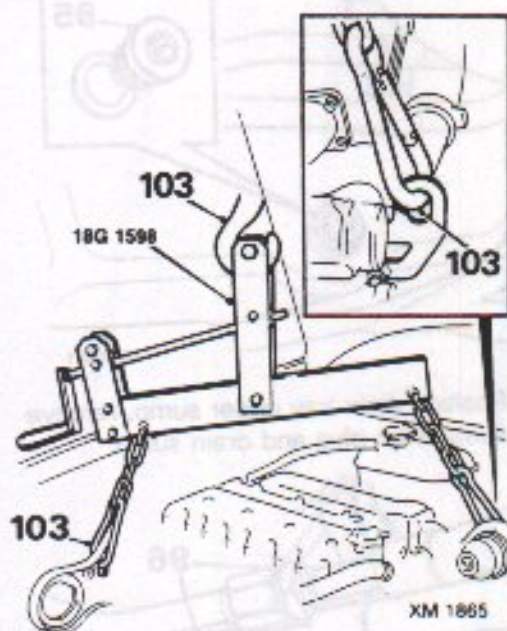
96. Disconnect 2 oil cooler hoses.  
97. Plug pipes and hoses.  
98. Remove drain tray.



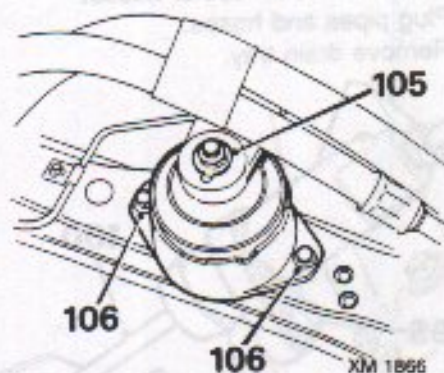
99. Remove 2 bolts securing clutch slave cylinder and move cylinder aside.  
100. Remove clutch push rod.



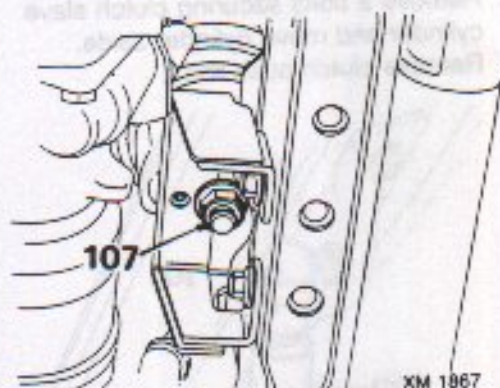
101. Remove 2 spring clips securing bonnet struts.  
102. Release struts from bonnet and tie bonnet back.



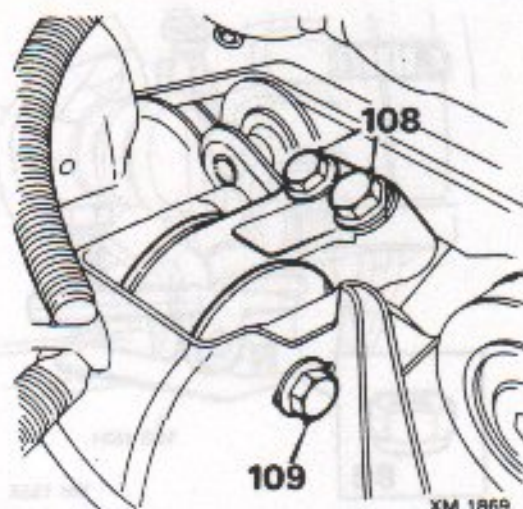
103. Fit tool 18G 1598 to engine and to lifting chains.  
104. Raise chain to take weight.



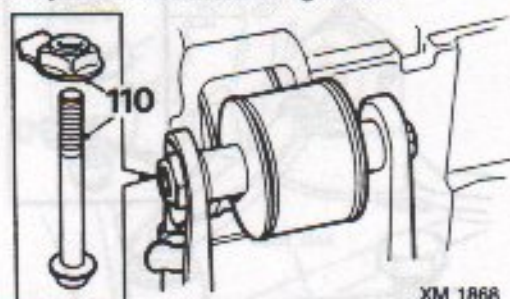
105. Remove front engine mounting top nut.  
106. Remove 2 bolts securing front mounting to crossmember.



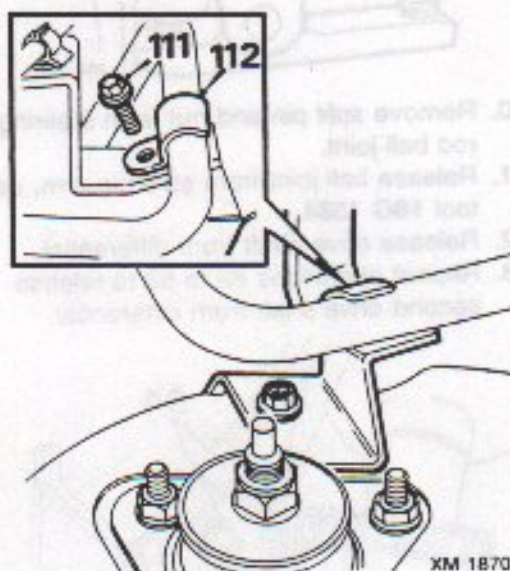
107. Remove rear engine mounting lower nut.



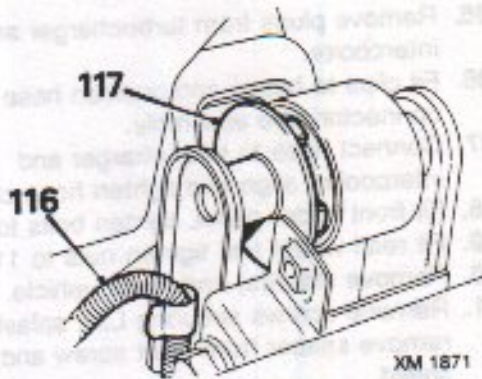
108. Remove 2 bolts securing engine R.H. mounting to engine.  
109. Slacken bolt securing R.H. mounting to body and move mounting aside.



110. Remove engine rear tie rod through bolt and remove special nut.



111. Remove screw securing air conditioning pipe clamp to bracket on L.H. suspension tower.  
112. Remove clamp.  
113. Raise engine and gearbox.  
114. Remove front mounting.  
115. Move clutch slave cylinder feed pipe clear of mounting bracket.



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116. Release harness from clip on tie rod bracket.
117. Remove engine rear tie rod rubber.
118. Raise and manoeuvre engine and gearbox out of engine bay.

#### Refit

1. Position engine and gearbox assembly over engine bay.
2. Lower and manoeuvre engine and gearbox into engine bay, positioning slave cylinder pipe over front mounting bracket.
3. Position engine front mounting and align engine and gearbox assembly to rear mounting bracket.
4. Lower power unit.
5. Align air conditioning pipe, position clamp, fit and tighten screw.
6. Fit rear tie rod rubber.
7. Position R.H. mounting, fit and tighten bolts, mounting to engine, to 75 Nm.
8. Align front mounting to crossmember, fit and tighten bolts to 45 Nm.
9. Align engine rear tie rod, position special nut, fit and tighten through - bolt to 45 Nm.
10. Secure harness to clip on tie rod bracket.
11. Fit front mounting top nut and tighten to 90 Nm.
12. Fit rear mounting bottom nut and tighten to 90 Nm.
13. Tighten R.H. mounting through - bolt to 45 Nm.
14. Lower lifting chain and disconnect tool 18G 1598 from power unit.
15. Untie bonnet, connect struts and fit spring clips.
16. Clean and lubricate clutch slave cylinder push rod.
17. Fit push rod to cylinder, align cylinder, fit and tighten bolts.
18. Remove plugs from oil cooler pipes and hoses, clean unions, connect hoses to pipes and tighten unions.
19. Clean drive shaft oil seal register and shaft end.
20. Clean front hub taper joint.
21. Lubricate seal running surface and shaft.
22. Fit shaft to differential, ensuring that snap ring has fully engaged and is retaining shaft in differential.
23. Position lower ball joint in lower arm, fit and tighten nut to 90 Nm.
24. Fit fork to shock absorber, fit and tighten bolt to 60 Nm.
25. Align fork to lower arm, fit and tighten bolt to 90 Nm.
26. Connect track rod end to steering arm, fit and tighten nut to 44 Nm.
27. Fit new split pin.
28. Position brake hose to suspension, fit and tighten bolts.
29. Position exhaust front bracket, fit and tighten bolts.
30. Connect speed transducer multiplug.
31. Position engine lower tie rod bracket and fit bolts.
32. Align tie rod, fit and tighten through - bolt to 45 Nm.
33. Position longitudinal beam, fit and tighten bolts to 45 Nm.
34. Align tie rod bracket to longitudinal beam, fit and tighten bolt.
35. Tighten remaining tie rod bracket bolts.
36. Align P.A.S. pipes to longitudinal beam, fit and tighten bolts.
37. Align gear cable bracket to gearbox, fit and tighten bolts.
38. Position gear selector inner cables through bracket and connect them to their respective levers.
39. Locate gear selector outer cables in bracket and secure them with their clips.
40. Feed engine harness across engine bay and connect fuel heater and switch leads.
41. Position expansion tank, fit and tighten screws securing tank.
42. Secure overflow hose clips to brake pipe.
43. Connect low coolant level sensor multiplug.
44. Connect engine harness multiplugs and secure multiplugs to bracket at R.H. side of engine bay.
45. Secure relays to bracket.
46. Connect air conditioning system dual and low pressure switch leads.
47. Connect engine harness multiplugs and push onto bracket on R.H. inner wing.
48. Fit clips to heater and feed hoses, connect hoses to coolant pipe, align and tighten clips.
49. Fit exhaust front pipe, see **MANIFOLD & EXHAUST - Repairs**.
50. Using new sealing washers, connect servo hose and tighten bolt to 40 Nm.
51. Fit clip to heater hose, connect hose to thermostat housing, align and tighten hose clip.



52. Fit clip to expansion hose, connect hose to coolant manifold align and tighten hose clip.
53. Untie P.A.S. pump, align pump to bracket, fit and tighten bolts.
54. Secure P.A.S. reservoir to clip.
55. Clean P.A.S. pump pulley and mating face, fit pulley, fit and tighten bolts securing pulley.
56. Align compressor, position threaded plate, fit and tighten bolts securing compressor.
57. Connect compressor lead.
58. Clean drive belt lower jockey centre bolt, position lower jockey, fit and tighten centre bolt.
59. Fit and adjust auxiliary drive belt, see **ELECTRICAL - Adjustments.**
60. Fit top hose to engine.
61. Align clip to P.A.S. pump bracket, fit and tighten nut.
62. Tighten top hose clip.
63. Connect overheat switch multiplug.
64. Feed throttle cable through abutment bracket.
65. Secure grommet to abutment bracket and secure sleeve to grommet.
66. Connect inner cable to throttle lever.
67. Adjust throttle cable, see **FUEL SYSTEM - Adjustments.**
68. Fit radiator, fan and cowl assembly, see **COOLING SYSTEM - Repairs.**
69. Fit warning label plate.
70. Tighten bonnet catch bolts.
71. Position expansion hose and harness, position clamps, fit and tighten screws.
72. Remove plugs from intercooler and intake elbow.
73. Fit intake hose to elbow, connect hose to intercooler and tighten hose clips.
74. Remove plugs from turbocharger and intercooler.
75. Fit clips to hoses and position hose and connector pipe assembly.
76. Connect hose to turbocharger and intercooler, align and tighten hose clips.
77. Fit front under panel, tighten bolts to 25 Nm.
78. Fit road wheel and tighten nuts to 110 Nm.
79. Remove stand(s) and lower vehicle.
80. Remove screws securing L.H. splash shield, remove spacer from front screw and remove shield.
81. Top - up gearbox oil level, see **MANUAL GEARBOX - Adjustments.**
82. Connect reverse lamp switch multiplug and secure switch cover.
83. Position splash shield, locate spacer to front screw, fit and tighten screws.
84. Position battery tray, fit and tighten bolts.
85. Fit battery, position battery clamp, fit and tighten nut securing clamp.
86. Connect main feed lead to battery terminal.
87. Connect battery lead to battery, fit and tighten terminal screw.
88. Secure terminal cover.
89. Fit air cleaner assembly, see **FUEL SYSTEM - Repairs.**
90. Refill cooling system, see **COOLING SYSTEM - Adjustments.**
91. Refill engine with correct quantity and grade of oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
92. If necessary, bleed the fuel system, see **FUEL SYSTEM - Adjustments.**

### Models fitted with ABS

74. Feed harness between body and ABS modulator, position glow plug control unit and connect leads to terminals.
75. Fit and tighten terminal nuts and connect multiplug to glow plug control unit.
76. Align glow plug control unit to body, fit and tighten bolt.

### All Models

77. Connect engine harness multiplugs at L.H. side of engine bay.
78. Position main feed cable to fuse box, fit and tighten screw and fit cover.
79. Fit main fuse cover.
80. Fit fuse box cover.
81. Remove plugs from fuel hoses, connect hoses and secure hose clips.
82. Fit turbocharger heatshield.
83. Position earth lead to backplate, fit and tighten bolt.
84. Position air cleaner bracket, fit and tighten bolts.

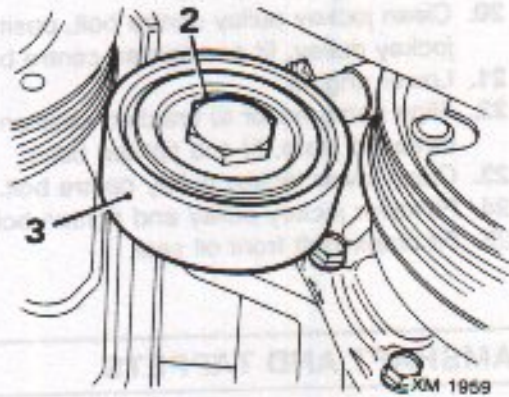


## TIMING COVER

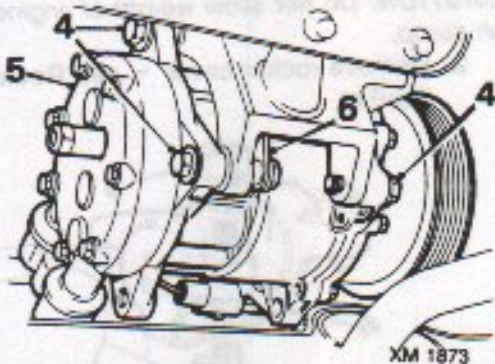
Service Repair No. 12.65.06

### Remove

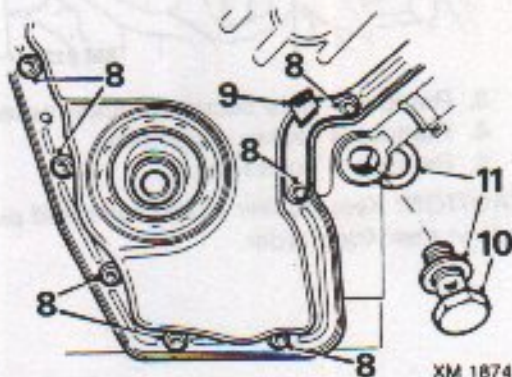
1. Remove crankshaft front oil seal.



2. Remove lower jockey pulley centre bolt (L.H. Thread).
3. Remove jockey pulley.

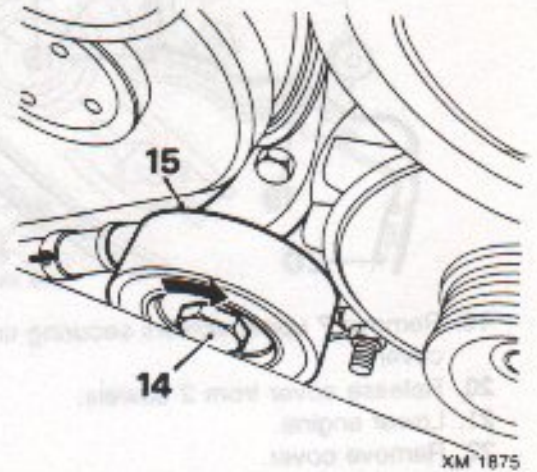


4. Remove 4 bolts securing air conditioning system compressor.
5. Release compressor from bracket.
6. Remove threaded plate.
7. Tie compressor aside.

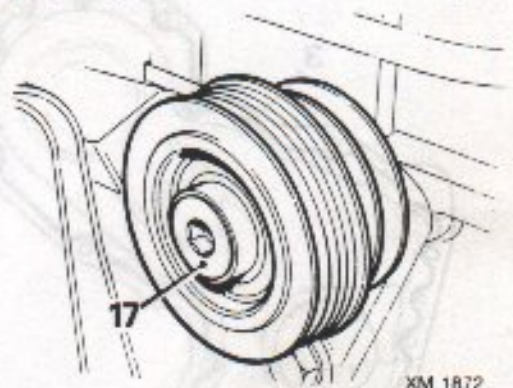


8. Remove 7 lower screws securing timing gear cover.
9. Remove timing pointer.
10. Remove brake servo pipe banjo bolt.
11. Discard 2 sealing washers.

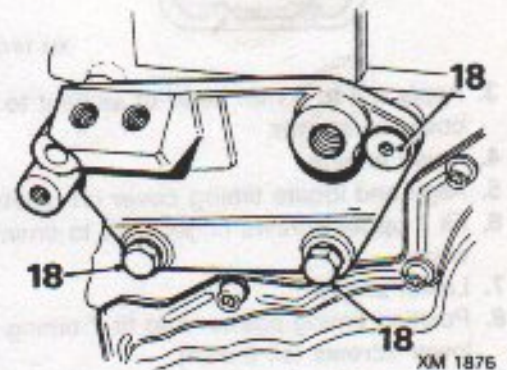
12. Position drain tray.
13. Raise engine.



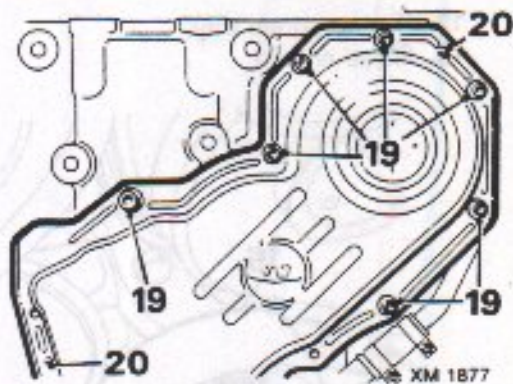
14. Remove centre bolt (L.H. thread) from jockey pulley adjacent to alternator.
15. Remove jockey pulley.
16. Remove auxiliary drive belt tensioner assembly, see **ELECTRICAL - Repairs**.



17. Remove coolant pump drive belt tensioner screw.



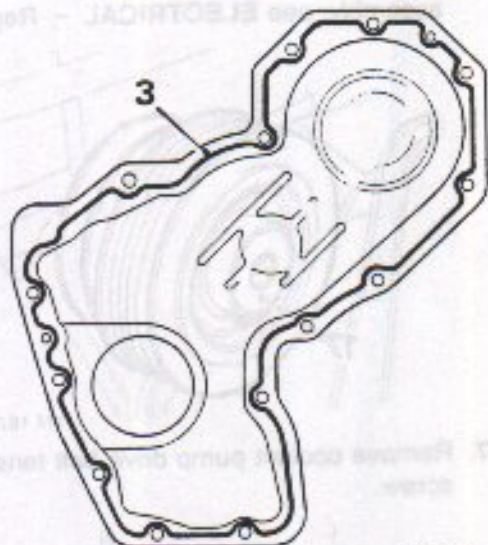
18. Remove 3 screws securing engine mounting plate and remove plate.



19. Remove 7 upper screws securing timing cover.
20. Release cover from 2 dowels.
21. Lower engine.
22. Remove cover.

### Refit

1. Clean sealant from mating faces of timing cover and block.
2. Clean inside and outside of timing cover.



3. Apply a 3 to 6 mm bead of sealant to timing cover as shown.
4. Raise engine.
5. Align and locate timing cover on dowels.
6. Fit 7 upper screws finger tight to timing cover.
7. Lower engine.
8. Position timing pointer and fit 7 timing cover lower screws (all 6 mm).
9. Tighten timing cover lower screws to 10 Nm.
10. Clean servo banjo bolt.
11. Position new sealing washers, fit and tighten banjo bolt to 40 Nm.
12. Raise engine.
13. Tighten 6 off 6 mm timing cover upper screws to 10 Nm.
14. Tighten 1 off 8 mm timing cover screw to 25 Nm.

15. Position engine mounting plate, fit and tighten screws.
16. Fit coolant pump drive belt tensioner screw.
17. Clean P.A.S. tensioner pivot, position tensioner assembly, fit washer and circlip.
18. Align tensioner and harness and hose clamp.
19. Fit and tighten top bolt.
20. Clean jockey pulley centre bolt, position jockey pulley, fit and tighten centre bolt.
21. Lower engine.
22. Align compressor to bracket, position threaded plate, fit and tighten bolts.
23. Clean lower jockey pulley centre bolt.
24. Fit lower jockey pulley and tighten bolt.
25. Fit crankshaft front oil seal.

## CAMSHAFT AND TAPPETS

Service Repair No. Camshaft - 12.13.02

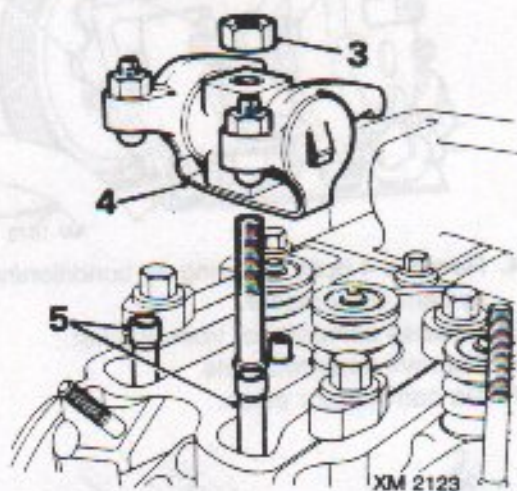
Service Repair No. Tappets - 12.29.57

### Remove

1. Remove engine and gearbox assembly.

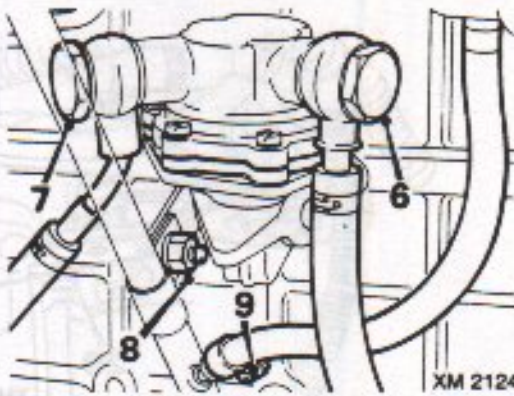
**CAUTION:** Do not allow weight of engine to rest on sump.

2. Remove rocker cover - see **Rocker Cover Gasket**



3. Remove 4 nuts securing rocker assemblies.
4. Remove 4 rocker assemblies.
5. Remove 8 push rods.

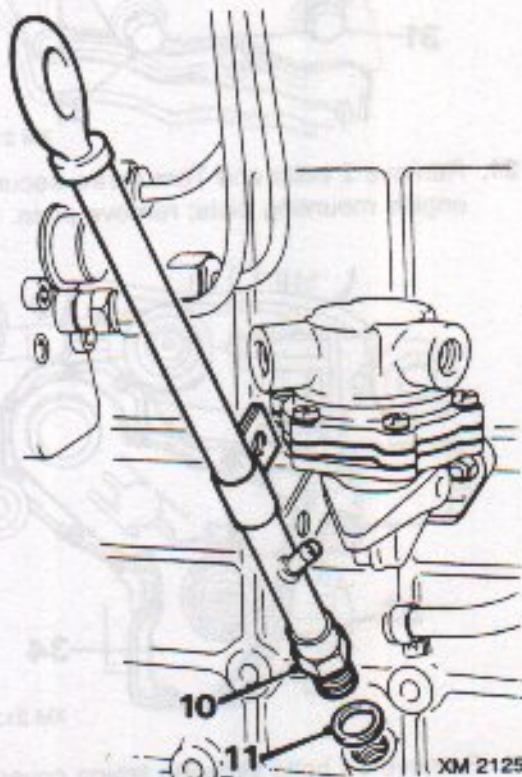
**CAUTION:** Keep rocker assemblies and push rods in their fitted order.



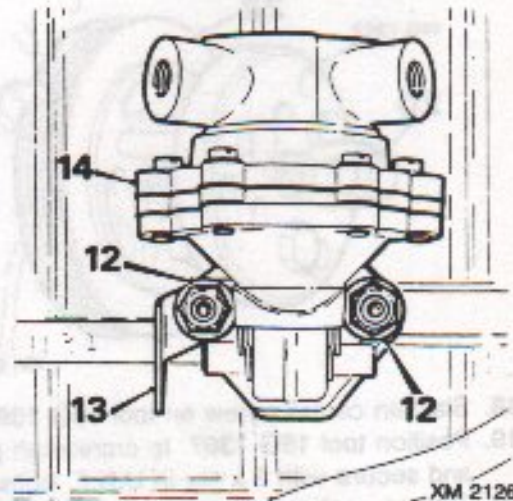
6. Remove fuel inlet hose banjo bolt from fuel lift pump, discard 2 sealing washers.
7. Remove fuel outlet hose banjo bolt from fuel lift pump, discard 2 sealing washers.

**CAUTION:** Plug open connections to prevent ingress of dirt.

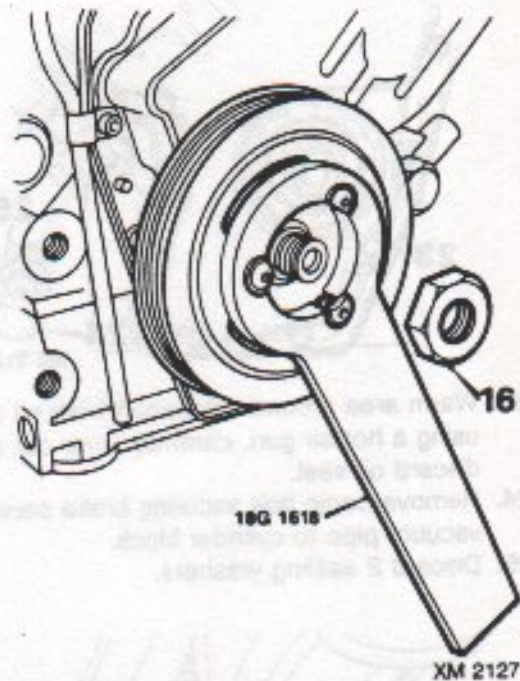
8. Remove bolt securing dipstick tube clip to bracket on fuel lift pump R.H. stud.
9. Slacken clip, disconnect breather hose from dipstick tube.



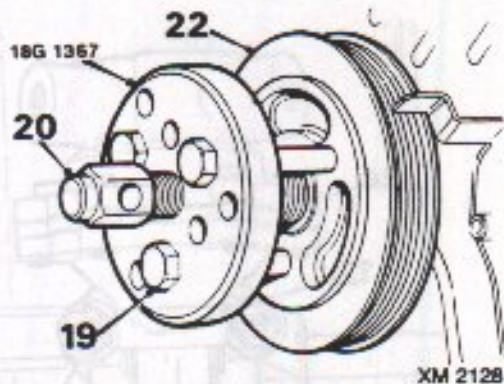
10. Unscrew dipstick tube.
11. Discard sealing washer.



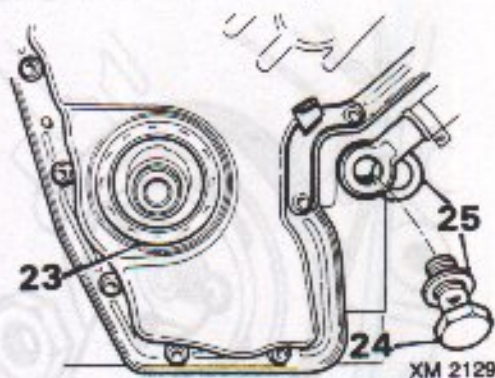
12. Remove 2 nuts securing fuel lift pump.
13. Release dipstick tube bracket from stud.
14. Remove fuel lift pump; discard 'O' ring.



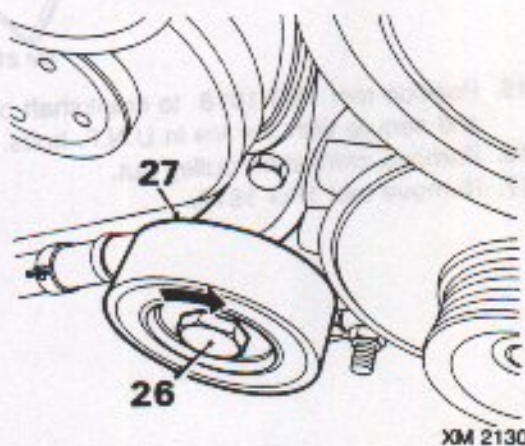
15. Position tool 18G 1618 to crankshaft pulley and secure with 3 x 5/16 in U.N.F. bolts.
16. Remove crankshaft pulley nut.
17. Remove tool 18G 1618.



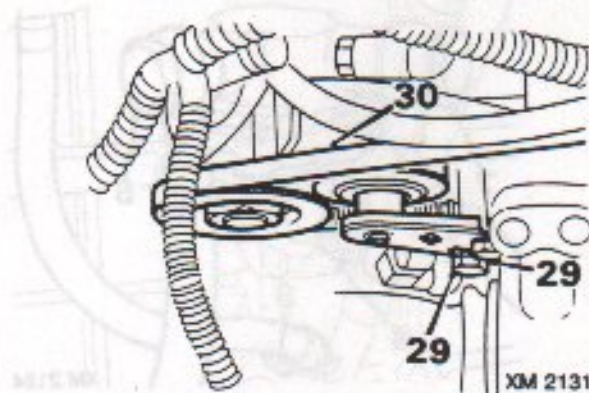
18. Slacken centre screw on tool 18G 1367.
19. Position tool 18G 1367 to crankshaft pulley and secure with 3 x 5/16 in U.N.F. bolts.
20. Tighten centre screw on tool 18G 1367 to release crankshaft pulley.
21. Remove tool 18G 1367.
22. Remove crankshaft pulley.



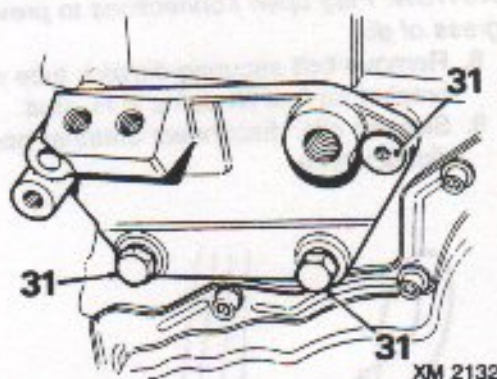
23. Warm area around crankshaft front oil seal using a hot air gun, carefully lever out seal; discard oil seal.
24. Remove banjo bolt securing brake servo vacuum pipe to cylinder block.
25. Discard 2 sealing washers.



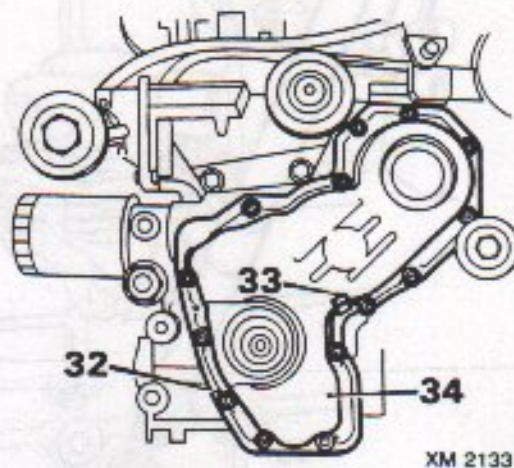
26. Remove upper jockey pulley securing bolt.
- Note:** Bolt has a L.H. thread
27. Remove upper jockey pulley.
  28. Remove auxiliary drive belt tensioner, see **ELECTRICAL - Repairs.**



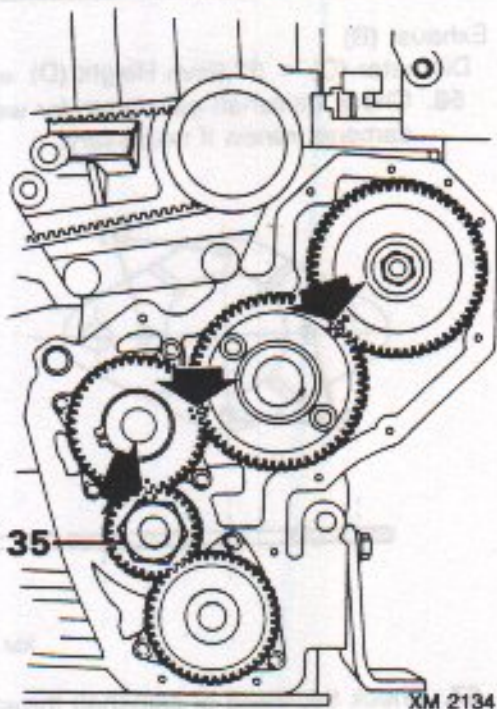
29. Remove 2 bolts securing coolant pump drive belt jockey pulley arm; remove jockey pulley arm.
30. Remove coolant pump drive belt.



31. Remove 2 bolts and Torx screw securing engine mounting plate; remove plate.

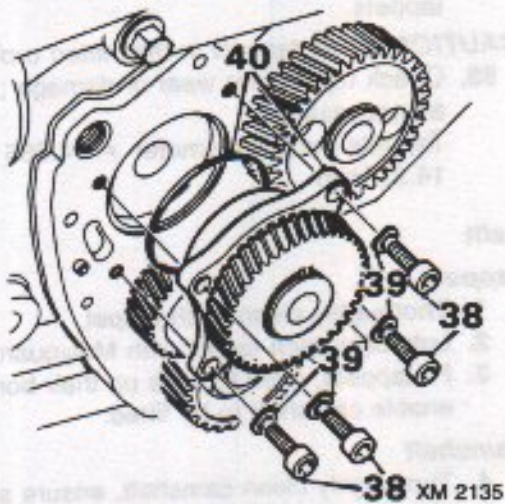


32. Remove 14 bolts securing timing cover, note fitted position of 8 mm bolt.
33. Remove timing pointer.
34. Release timing cover from locating dowels.



XM 2134

35. Fit but do not tighten crankshaft pulley nut.
36. Turn crankshaft clockwise until timing marks are aligned.
37. Remove crankshaft pulley nut.

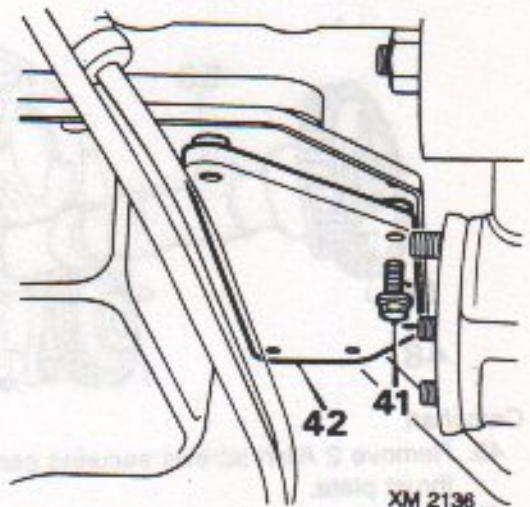


XM 2135

38. Remove 4 Allen screws securing brake servo vacuum pump.

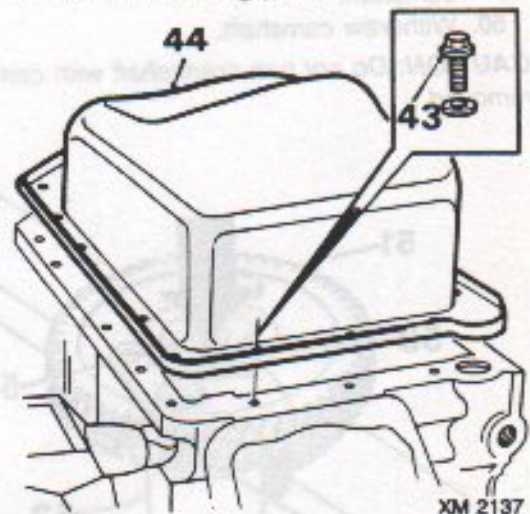
**Note:** Allen screw fitted nearest to crankshaft timing gear has smaller diameter head than other 3 screws.

39. Remove 4 wave washers.
40. Remove brake servo vacuum pump; discard 'O' ring.



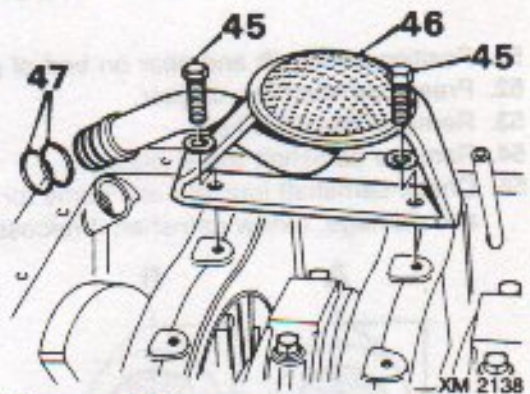
XM 2136

41. Remove 6 bolts securing reinforcing plate.
42. Remove reinforcing plate.



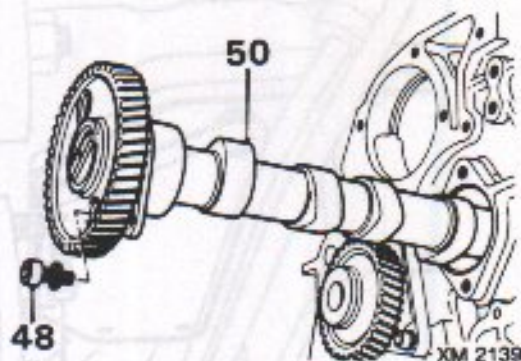
XM 2137

43. Remove 14 remaining bolts securing sump.
44. Remove sump.



XM 2138

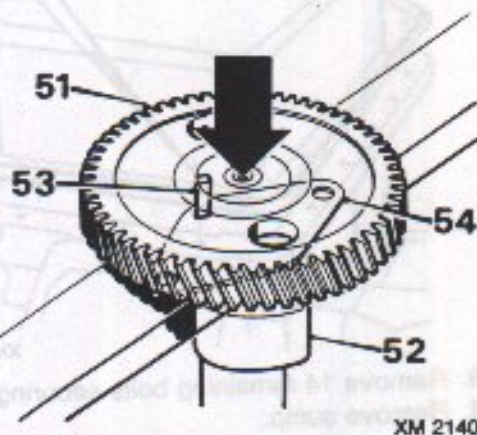
45. Remove 2 bolts securing oil pick - up strainer to cylinder block.
46. Remove strainer.
47. Discard 2 'O' rings from oil pick - up pipe.



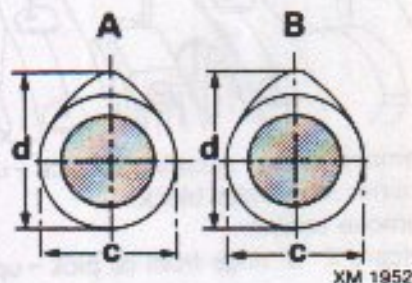
### Camshaft

48. Remove 2 Allen screws securing camshaft thrust plate.
49. Using a suitable stick magnet inserted in push rod guides, raise tappets clear of camshaft.
50. Withdraw camshaft.

**CAUTION:** Do not turn crankshaft with camshaft removed.



51. Position camshaft and gear on bed of press.
52. Press camshaft out of gear.
53. Remove Woodruff key.
54. Remove camshaft thrust plate.
55. Check camshaft journals and cams for wear and damage; renew camshaft if necessary.



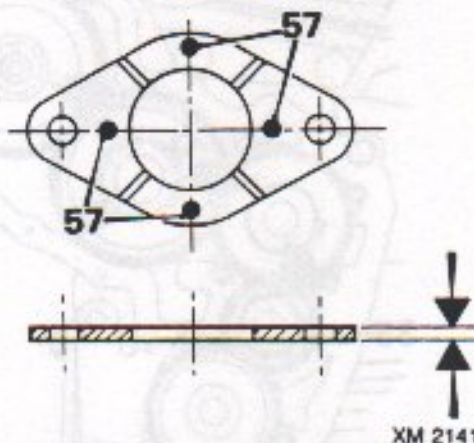
Cam lobe minimum dimensions  
Inlet (A)

- Diameter (C) = 38.5mm  
Height (D) = 45.7mm

Exhaust (B)

Diameter (C) = 37.5mm Height (D) = 45.14mm

56. Check camshaft gear teeth for wear or damage; renew if necessary.



57. Check thickness of camshaft thrust plate at 4 points; renew thrust plate if thickness is less than 3.95 mm.

### Tappets

58. Using a suitable stick magnet: remove tappets.

**CAUTION:** Keep tappets in their fitted order.

59. Check tappets for wear or damage; renew as necessary.  
Tappets outside diameter = 14.965 to 14.985mm

### Refit

#### Tappets

1. Thoroughly clean each tappet.
2. Lubricate each tappet with Molyguard.
3. Fit tappets, push tappets up their bores to enable camshaft to be fitted.

#### Camshaft

4. Thoroughly clean camshaft, ensure all oilways are clear.
5. Clean camshaft bearings.
6. Clean camshaft gear, thrust plate and mating surface of cylinder block.
7. Position thrust plate on camshaft.
8. Fit Woodruff key to slot in camshaft.
9. Position camshaft gear to camshaft, position camshaft on bed of suitable press and align keyway in gear with Woodruff key.
10. Press gear on to camshaft, remove camshaft from press.
11. Lubricate camshaft cams, bearing journals and bearings with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
12. Position camshaft in cylinder block aligning timing marks on camshaft gear with those on fuel injection pump gear.



**CAUTION:** Ensure tappets are clear of camshaft as it is being fitted.

13. Position camshaft thrust plate, fit 2 Allen screws and spring washers; tighten Allen screws to 24 Nm.
14. Ensure oil pick-up strainer and mating faces are clean.
15. Lubricate 2 new 'O' rings with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
16. Fit 2 new 'O' rings to oil pick-up pipe, fit strainer; fit 2 bolts and tighten to 25 Nm.
17. Clean RTV from sump and cylinder block mating faces, clean sump and reinforcing plate.
18. Apply RTV to sump mating face, position sump on cylinder block and fit 14 bolts finger tight.
19. Position reinforcing plate and fit 6 bolts finger tight.
20. Progressively tighten sump and reinforcing plate bolts to 11 Nm.
21. Clean brake servo vacuum pump and cylinder block mating faces.
22. Lubricate new 'O' ring with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**; fit 'O' ring to vacuum pump.
23. Position vacuum pump to engine ensuring timing marks on camshaft, crankshaft, vacuum pump and fuel injection pump gears are aligned.
24. Fit 4 Allen screws and wave washers.

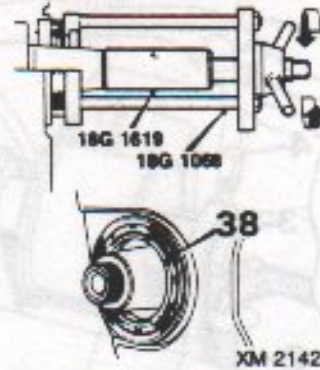
**Note:** Allen screw with smallest diameter head must be fitted nearest crankshaft timing gear.

25. Tighten 4 Allen screws to 27 Nm.
26. Clean RTV from mating faces of timing cover and cylinder block, clean timing cover.
27. Apply 3 to 6 mm bead of RTV to timing cover, position cover on 2 locating dowels.
28. Position timing pointer, fit 13 x 6 mm bolts and 8 mm bolt; tighten bolts by diagonal selection to:
  - 6 mm bolts: 10 Nm
  - 8 mm bolt: 25 Nm
29. Position brake servo vacuum pipe union to cylinder block, fit banjo bolt and 2 new sealing washers, tighten banjo bolt to 40 Nm.
30. Position engine mounting plate, fit 2 bolts and Torx screw and tighten to 45 Nm.
31. Position coolant pump drive belt tensioner, fit 2 bolts finger tight.
32. Clean coolant pump and tensioner pulley; position coolant pump drive belt to pulleys.
33. Tension coolant pump drive belt, see **COOLING SYSTEM - Adjustments**.
34. Fit auxiliary drive belt tensioner, see **ELECTRICAL - Repairs**.

35. Clean upper jockey pulley securing bolt and jockey pulley.
36. Position upper jockey pulley, fit centre bolt and tighten to 45 Nm.

**Note:** Bolt has a L.H. thread.

37. Lubricate new crankshaft front oil seal with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**



38. Fit crankshaft front oil seal using tools 18G 1068 and 18G 1618.
39. Clean crankshaft and pulley; fit pulley.
40. Clean threads of crankshaft pulley nut, apply Loctite 601 to threads of nut and fit nut.
41. Position tool 18G 1618 to crankshaft pulley and secure with 3 x 5/16 in U.N.F. bolts.
42. Tighten crankshaft pulley nut to 177 Nm.
43. Remove tool 18G 1618.
44. Clean fuel lift pump and cylinder block mating faces.
45. Lubricate a new 'O' ring with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**; fit 'O' ring to fuel lift pump.
46. Position fuel lift pump on studs, position dipstick tube bracket; fit 2 nuts and tighten to 35 Nm.
47. Fit new dipstick tube sealing washer; fit dipstick tube.
48. Connect breather hose; tighten hose clip.
49. Align dipstick tube clip to bracket, fit and tighten bolt.
50. Fit fuel inlet and outlet hoses to fuel lift pump; use new sealing washers; tighten banjo bolts to 19 Nm.
51. Lubricate push rods with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**; fit push rods.
52. Clean rocker assemblies and mating faces, fit 4 rocker assemblies.
53. Lubricate 4 rocker securing nuts with Molyguard, fit nuts and tighten to 108 Nm.
54. Adjust valve rocker clearances - see **Adjustments**.
55. Fit engine and gearbox assembly.



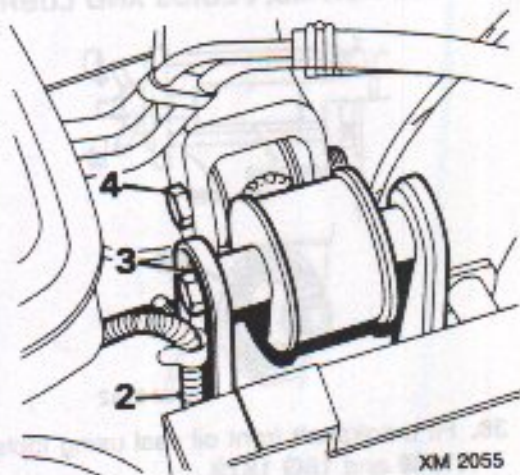
## ENGINE REAR TIE ROD

Service Repair No. 12.45.16

### Remove

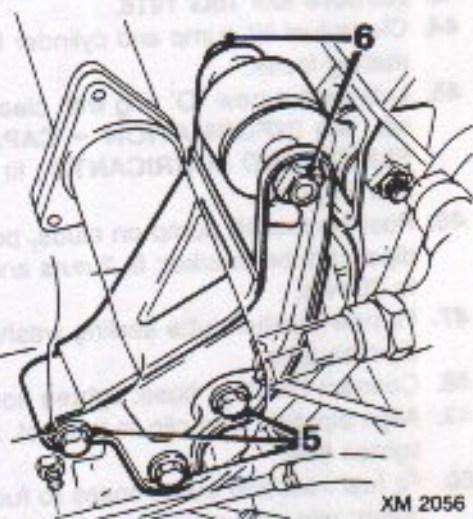
1. Raise front of vehicle.

**WARNING: Support on safety stands.**



XM 2055

2. Release harness from clip on tie rod bracket.
3. Slacken but do not remove tie rod to engine bracket bolt.
4. Remove bolt securing tie rod to bulkhead bracket.



XM 2056

5. Remove 3 bolts, engine bracket to engine; remove bracket and tie rod.
6. Remove bolt, tie rod to engine bracket, remove tie rod and recover special nut.

### Refit

1. Position tie rod to engine bracket, fit bolt and special nut.

**Note: Do not tighten bolt at this stage.**

2. Position engine bracket and tie rod to engine, fit 3 bolts and tighten to 83 Nm.
3. Secure harness in clip.
4. Align tie rod to bulkhead bracket, fit bolt and tighten to 82 Nm.

5. Tighten tie rod to engine bracket bolt to 82 Nm.
6. Remove stand(s) and lower vehicle.

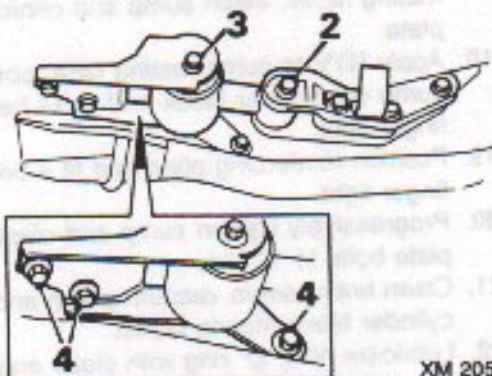
## ENGINE FRONT TIE ROD

Service Repair No. 12.45.17

### Remove

1. Raise front of vehicle.

**WARNING: Support on safety stands.**



XM 2059

2. Remove bolt, tie rod to clutch housing bracket.
3. Slacken but do not remove bolt, tie rod to front bracket.
4. Remove 2 bolts, front bracket to crossmember and bolt, front bracket to longitudinal beam; remove bracket and tie rod.
5. Remove bolt, tie rod to front bracket; remove tie rod and recover special nut.

### Refit

1. Position tie rod to front bracket, fit bolt and special nut.

**Note: Do not tighten bolt at this stage.**

2. Position front bracket and tie rod to crossmember and longitudinal beam, fit 3 bolts and tighten to 45 Nm.
3. Align tie rod to clutch housing bracket, fit bolt and tighten to 45 Nm.
4. Tighten tie rod to front bracket bolt to 45 Nm.
5. Remove stand(s) and lower vehicle.



## REAR CENTRE ENGINE MOUNTING

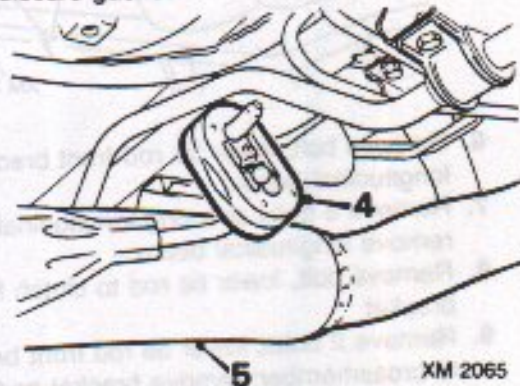
Service Repair No. 12.45.08

### Remove

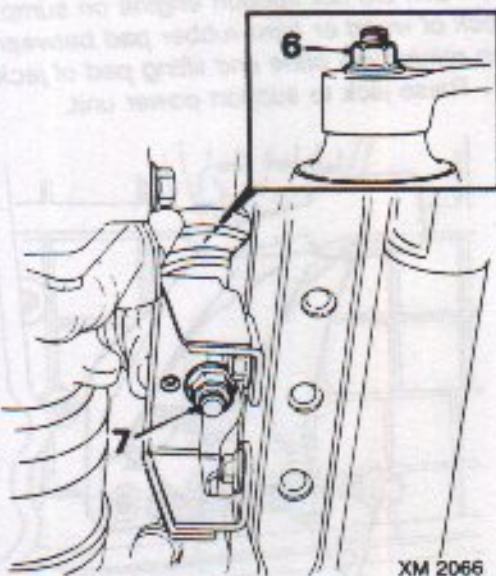
1. Remove R.H. drive shaft, see **DRIVE SHAFTS - Repairs**.



2. Remove 3 nuts, exhaust down pipe to intermediate pipe.
3. Separate down pipe from intermediate pipe; discard gasket.



4. Release down pipe from mounting rubber.
5. Remove down pipe, see **MANIFOLD & EXHAUST - Repairs**

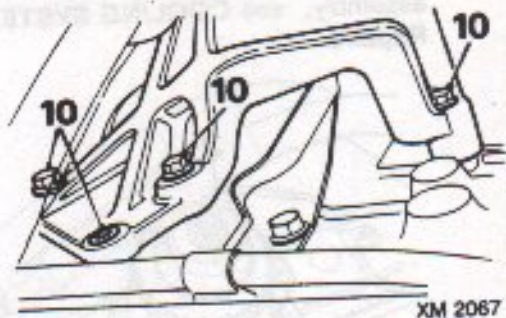


6. Remove nut securing rear engine mounting rubber to engine bracket.
7. Remove nut securing rear engine mounting rubber to crossmember bracket.

8. Position trolley jack beneath differential housing.

**CAUTION:** Use a block of wood or hard rubber pad between differential housing and lifting pad of jack.

9. Raise jack to support engine and gearbox assembly.



10. Remove 3 bolts and Torx screw securing rear engine mounting bracket to cylinder block.
11. Remove rear engine mounting bracket and rear engine mounting rubber.

### Refit

1. Position rear engine mounting rubber to crossmember bracket.

**Note:** Do not fit mounting rubber securing nut at this stage.

2. Position rear engine mounting bracket to engine and rear engine mounting rubber.

**Note:** Do not fit mounting rubber securing nut at this stage.

3. Fit 3 bolts and Torx screw and tighten to 45 Nm.
4. Remove trolley jack.
5. Fit 2 nuts, rear engine mounting rubber to engine and crossmember brackets; tighten nuts to 90 Nm.
6. Position exhaust down pipe to intermediate pipe, use a new gasket; fit but do not tighten 3 nuts.
7. Attach down pipe to mounting rubber.
8. Fit R.H. drive shaft, see **DRIVE SHAFTS - Repairs**.

**Note:** Do not lower vehicle at this stage.

9. Tighten 3 nuts, exhaust down pipe to intermediate pipe to 30 Nm.
10. Remove stand(s) and lower vehicle.

## FRONT CENTRE ENGINE MOUNTING

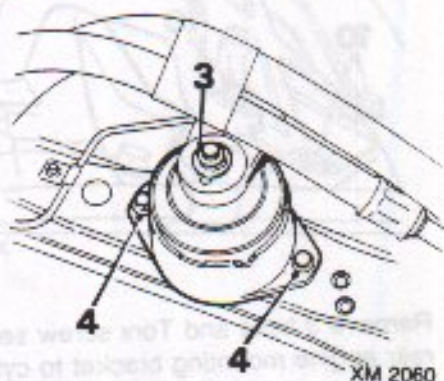
Service Repair No. 12.45.02

### Remove

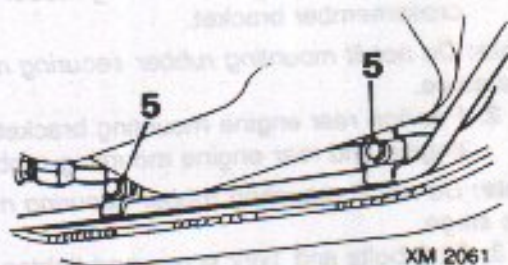
1. Raise front of vehicle.

**WARNING: Support on safety stands.**

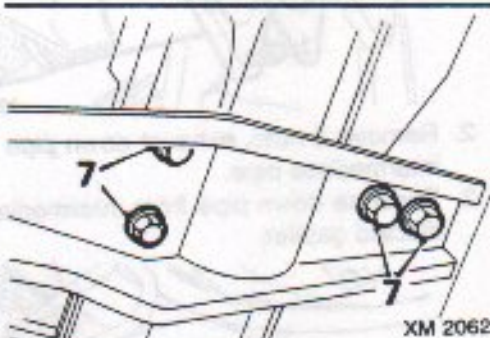
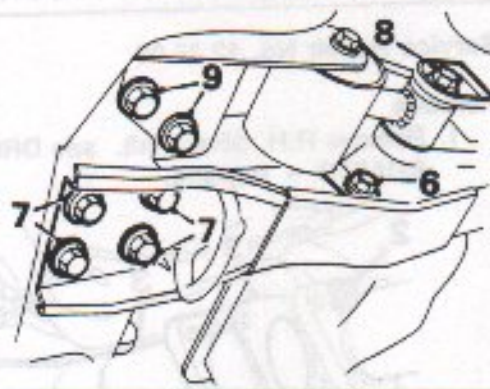
2. Remove cooling fan, motor and cowl assembly, see **COOLING SYSTEM - Repairs.**



3. Remove nut securing front mounting to engine bracket.
4. Remove 2 bolts securing front mounting to crossmember.



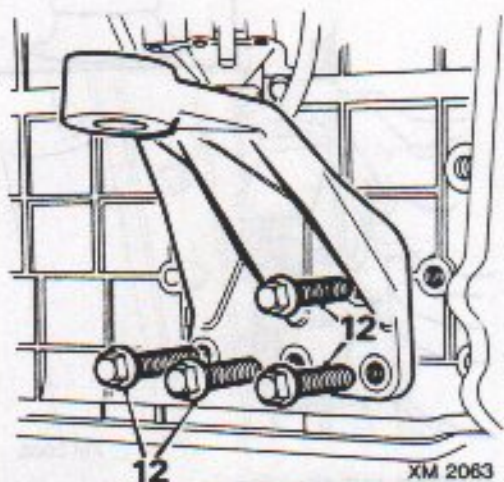
5. Remove 2 bolts securing P.A.S. pipe clamps to longitudinal beam.



6. Remove bolt, lower tie rod front bracket to longitudinal beam.
7. Remove 8 bolts securing longitudinal beam; remove longitudinal beam.
8. Remove bolt, lower tie rod to clutch housing bracket.
9. Remove 2 bolts, lower tie rod front bracket to crossmember; remove bracket and tie rod.
10. Position trolley jack beneath sump reinforcing plate.

**CAUTION: Do not support engine on sump. Use a block of wood or hard rubber pad between sump reinforcing plate and lifting pad of jack.**

11. Raise jack to support power unit.



12. Remove 4 bolts securing mounting bracket to cylinder block; remove bracket and front mounting.

**Refit**

1. Position front mounting and bracket to engine.

**Note:** Do not fit front mounting nut at this stage.

2. Fit 4 bolts, mounting bracket to cylinder block; tighten bolts to 45 Nm.
3. Remove trolley jack.
4. Position lower tie rod and bracket to crossmember, fit 2 bolts, bracket to crossmember.

**Note:** Do not tighten bolts at this stage.

5. Align lower tie rod to clutch housing bracket, fit bolt and tighten to 45 Nm.
6. Position longitudinal beam, fit 8 bolts and tighten to 45 Nm.
7. Fit bolt, lower tie rod bracket to longitudinal beam, tighten 3 bolts securing lower tie rod bracket to 45 Nm.
8. Fit 2 clamps and bolts, P.A.S. pipes to longitudinal beam, tighten bolts to 10 Nm.
9. Align front mounting to crossmember, fit 2 bolts and tighten to 45 Nm.
10. Fit nut securing front mounting to bracket; tighten nut to 85 Nm.

**CAUTION:** Ensure that spigot on front mounting is located in hole in bracket.

11. Fit cooling fan, motor and cowl assembly, see **COOLING SYSTEM - Repairs**.
12. Remove stand(s) and lower vehicle.

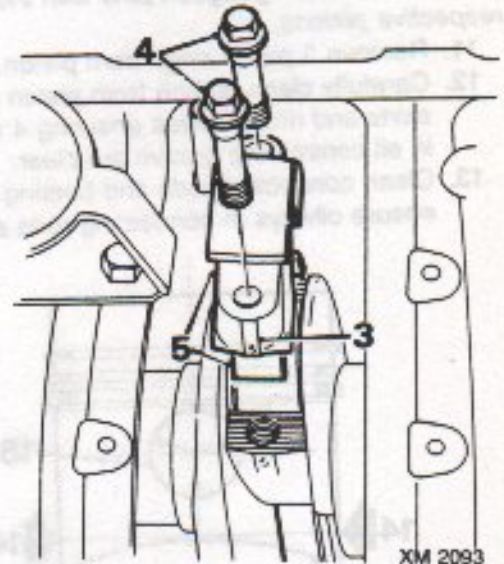
## PISTONS, CONNECTING RODS AND CYLINDER LINERS

**Service Repair No. Pistons and connecting rods - 12.17.03**

**Service Repair No. Cylinder liners - 12.25.26**

**Remove**

1. Remove cylinder heads, see **Cylinder Head Gaskets**.
2. Remove oil pick-up strainer.

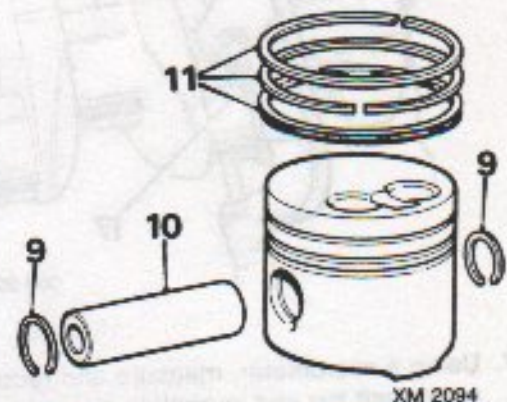


3. Check that identification numbers 1 to 4 are stamped on big end bearing caps and connecting rods; if caps are not marked, mark reference numbers on L.H. side of connecting rod and bearing cap (viewed from flywheel end of engine).
4. Remove 2 bolts securing each big end bearing cap, rotate crankshaft as necessary to obtain access.
5. Remove each bearing cap and bearing shell.
6. Push each connecting rod up cylinder bore until piston and connecting rod can be withdrawn.
7. Remove bearing shell from connecting rod and bearing cap.

**CAUTION:** If bearing shells are to be refitted, keep each shell with its respective connecting rod and bearing cap.

**Pistons and connecting rods**

8. Secure connecting rod in a soft jawed vice.

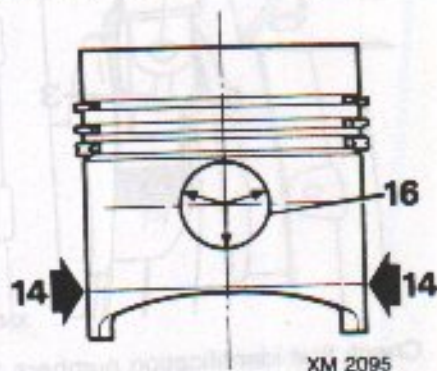


9. Using suitable circlip pliers, remove 2 circlips securing gudgeon pin.
10. Push gudgeon pin out of piston and connecting rod; remove piston.

# ENGINE

**CAUTION:** Retain gudgeon pins with their respective pistons.

11. Remove 3 piston rings from piston.
12. Carefully clean carbon from piston crowns, skirts and ring grooves ensuring 4 oil holes in oil control ring groove are clear.
13. Clean connecting rods and bearing caps, ensure oilways in connecting rods are clear.



14. Using a micrometer, measure diameter of pistons; record measurements obtained.

**Note:** Measurement must be taken at right angles to gudgeon pin bore and at 15 mm from bottom of piston skirt.

15. Check which grade of piston is fitted and compare measurement obtained with figures given.

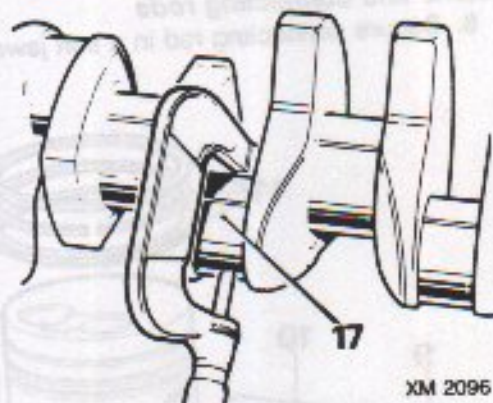
Grade A = 91.92 to 91.93 mm

Grade B = 91.93 to 91.94 mm

Maximum wear limit = 0.05 mm

16. Check gudgeon pin bores in pistons for ovality; make 3 checks at 120° intervals. Maximum ovality = 0.05 mm

**Note:** Pistons worn beyond above limits must be renewed.

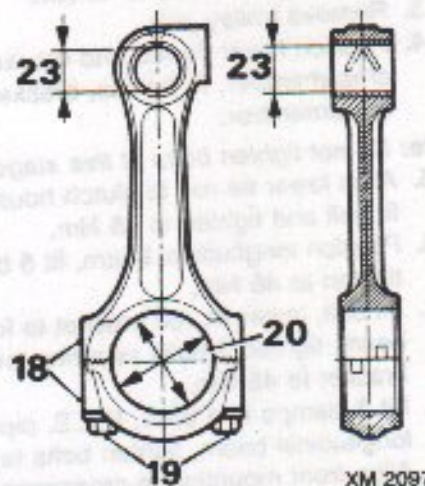


17. Using a micrometer, measure and record crankshaft big end journal diameters; take 3 measurements of each journal at 120° intervals.

Journal diameter = 53.84 to 53.955 mm

**Note:** Crankshafts with big end journals worn beyond above limits or showing signs of ovality must be renewed or reground.

Minimum regrind diameter = 53.69 mm



18. Assemble bearing shells and bearing caps to their respective connecting rods ensuring that serrations on cap and rod and reference marks are aligned.

19. Fit bearing cap bolts and tighten to 29 Nm then a further 60°.

20. Check and record internal diameter of big end bearing. Big end bearing internal diameter = 53.977 to 54.016 mm

21. Compare internal diameters of big end bearings with crankshaft big end bearing journal diameters.

Maximum clearance between big end bearings and journals = 0.022 to 0.076 mm

**Note:** If bearing clearance exceeds above figure, undersize bearings or new crankshaft must be fitted.

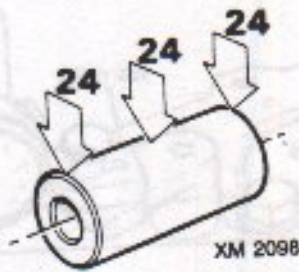
Bearing undersize available = 0.25 mm

22. Remove big end bearing cap bolts, bearing caps and bearing shells.

**Note:** Keep bearing shells with their respective bearing caps and connecting rods.

23. Measure and record internal diameter of gudgeon pin bush in connecting rods. Gudgeon pin bush internal diameter = 30.030 to 30.045 mm.

**Note:** If gudgeon pin bush internal diameter exceeds dimensions given, connecting rod and bush must be renewed as an assembly.



24. Measure and record diameter of gudgeon pins.  
Gudgeon pin diameter = 29.990 to 29.996 mm

**Note:** Measurements must be taken at both ends and centre of gudgeon pin.

25. Check from dimensions obtained that, when fitted, there is a nominal clearance of 0.034 to 0.055 mm between gudgeon pin and gudgeon pin bush.  
Maximum clearance - gudgeon pin to gudgeon pin bush = 0.10 mm

**Note:** If maximum clearance exceeds figure given, gudgeon pin and piston must be renewed.

26. Insert piston rings in turn into cylinder bore, push ring to mid point of bore and check ring gap.  
Piston ring gap  
1st (Top) compression ring gap = 0.25 to 0.50 mm  
2nd compression ring gap = 0.25 to 0.45 mm  
Oil control ring rails gap = 0.25 to 0.58 mm

**Note:** If ring gaps exceed dimensions given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

27. Lubricate piston ring grooves and piston rings with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
28. Fit 2 rails and oil control expander ring to bottom groove in piston.
29. Fit 2nd compression ring to middle groove in piston.

**Note:** Fit ring with word 'TOP' facing towards piston crown.

30. Fit 1st compression ring to top groove in piston.
31. Position oil control expander ring gap at 30° to left of combustion recess.
32. Position 2nd compression ring gap at 180° to combustion recess.
33. Position 1st compression ring gap at 30° to right of combustion recess.
34. Position gaps in oil control ring rails at 180° to each other.

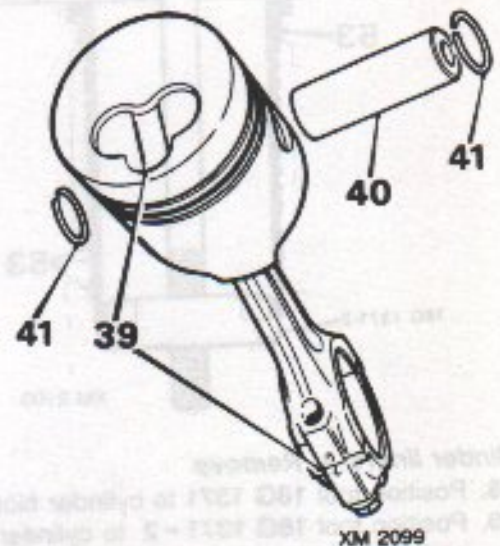
35. Check side clearance of piston rings in grooves.

Piston ring side clearance

- 1st (Top) compression ring = 0.080 to 0.130 mm  
2nd compression ring = 0.070 to 0.102 mm  
Oil control ring = 0.040 to 0.072 mm

**Note:** If piston ring side clearances exceed dimensions given, new rings must be fitted.

36. Compress oil control expander ring level with piston skirt; ensure that when compressed, ends of ring butt together and do not overlap.
37. Secure connecting rod in soft jawed vice.
38. Lubricate gudgeon pin and gudgeon pin bush with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**



39. Position piston to connecting rod.

**CAUTION:** Ensure combustion recess in piston crown and big end bearing cap reference numbers on connecting rod are on the same side.

40. Fit gudgeon pin.
41. Fit 2 circlips to retain gudgeon pin; use suitable circlip pliers.
42. Remove connecting rod from vice.

#### Cylinder Liners - Check

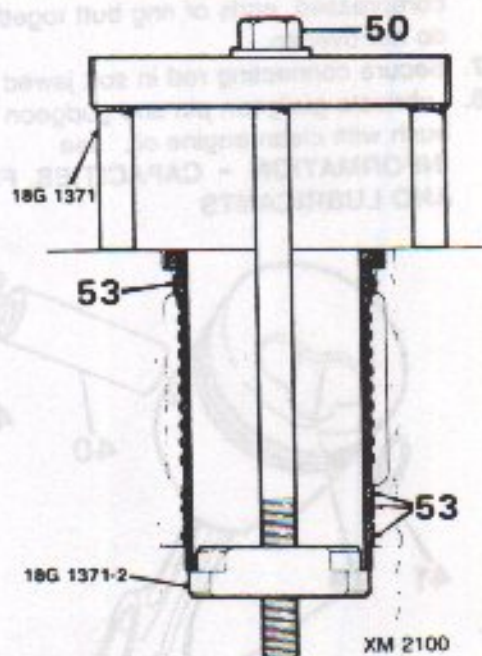
43. Clean carbon from tops of cylinder liners.
44. Position cloth over crankshaft big end journals.
45. Check cylinder liner for wear and ovality at top, centre and bottom of liner; make 3 checks at 120° intervals at each location.  
Cylinder liner internal diameter  
Grade 'A' - No identification mark  
= 92.000 to 92.010 mm

# ENGINE

Grade 'B' - Identified by notch machined in bottom edge of liner = 92.010 to 92.020 mm

**Note:** Cylinder liners worn beyond dimensions given or showing signs of scoring must be renewed.

46. De-glaze cylinder liners using suitable equipment.
47. Thoroughly clean cylinder liners, remove cloth from crankshaft big end journals.



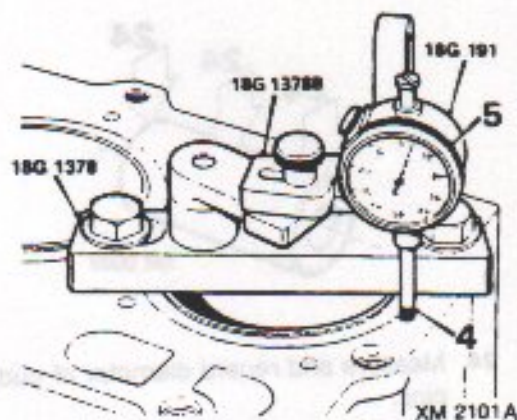
## Cylinder liners - Remove

48. Position tool 18G 1371 to cylinder block.
49. Position tool 18G 1371-2 to cylinder liner and screw centre bolt of tool 18G 1371 into tool 18G 1371-2.
50. Tighten centre bolt of tool 18G 1371 and withdraw cylinder liner.
51. Remove tool 18G 1371 and tool 18G 1371-2.
52. Remove shim(s) from cylinder liner or cylinder block recess.
53. Remove and discard 4 'O' rings.

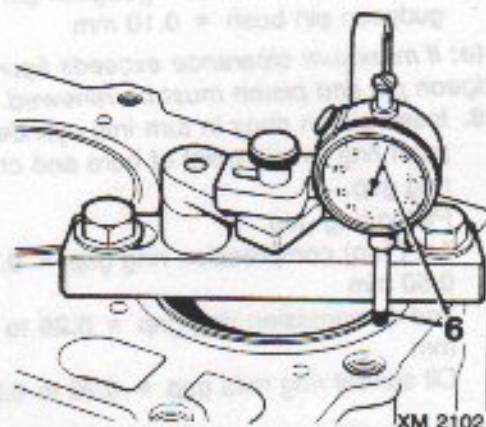
## Refit

### Cylinder liners

1. Thoroughly clean cylinder liner recess in cylinder block, degrease contact points of cylinder liner bore in block.
2. Position cylinder liner less shim(s) and 'O' rings in cylinder block; rotate liner through 90° several times to seat it correctly.



3. Position tool 18G 1378 to cylinder block; fit and tighten 2 bolts to retain tool.
4. Fit tool 18G 191 to tool 18G 1378B and position stylus of tool 18G 191 to cylinder block.
5. Zero dial gauge.



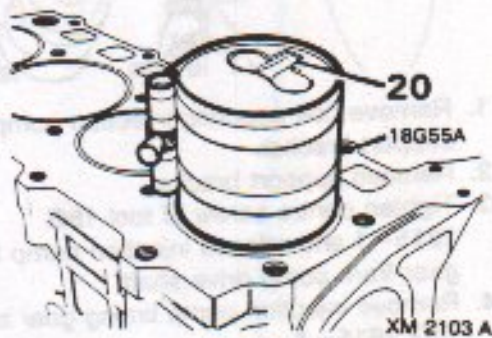
6. Position stylus of tool 18G 191 to cylinder liner; note and record reading on dial gauge.
7. Remove tool 18G 1378B and tool 18G 191.
8. Remove cylinder liner.
9. Select shim(s) with a total thickness equalling dimension recorded plus additional shim(s) which will give a cylinder liner protrusion above cylinder block of 0.01 to 0.06 mm.

**Note:** Shims of 0.15; 0.17; 0.20; 0.23 and 0.25 mm thickness are available.

10. Fit shims selected to cylinder liner.
11. Lubricate 4 new 'O' rings with Molyguard; fit 'O' rings to cylinder liner at following locations:  
 Top groove - 1 brown 'O' ring  
 Centre grooves - 2 black 'O' rings  
 Bottom groove - 1 brown 'O' ring



12. Lubricate bottom portion of cylinder liner and mating surface of cylinder block with Molyguard.
13. Apply Loctite 275 to cylinder liner recess in cylinder block.
14. Fit cylinder liner.
15. Retain cylinder liner using tool 18G 1378 until Loctite has cured.
16. Remove 18G 1378B.



#### Pistons and connecting rods

17. Compress piston rings using tool 18G 55A.
- CAUTION:** Ensure piston ring gaps are correctly positioned as compressor is tightened.
18. Fit big end bearing shells to connecting rod and big end bearing cap.
  19. Lubricate piston, connecting rod journals, big end bearing shells and caps with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
  20. Position piston and connecting rod assembly to appropriate cylinder bore ensuring that piston combustion recess is towards L.H. side of engine (viewed from flywheel end).
  21. Push piston down cylinder bore keeping ring compressor in firm contact with cylinder liner.

**CAUTION:** Ensure big end bearing locates over crankshaft journal as piston is fitted.

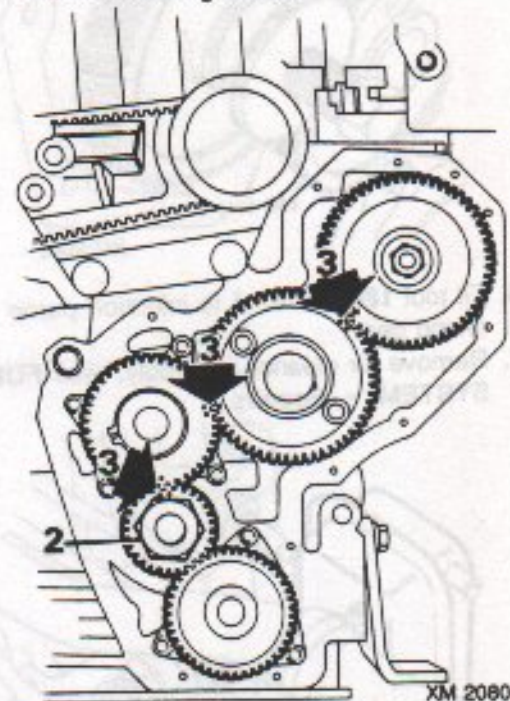
22. Remove tool 18G 55A.
23. Fit big end bearing cap and bearing shell ensuring that big end bearing reference marks and serrations on connecting rod and bearing cap are aligned.
24. Lubricate threads of bearing cap bolts with Molyguard.
25. Fit 2 bearing cap bolts, tighten each bolt to 29 Nm then a further 60°.
26. Fit oil pick-up strainer.
27. Fit cylinder heads - see **Cylinder Head Gaskets**.

## FUEL INJECTION PUMP TIMING GEAR

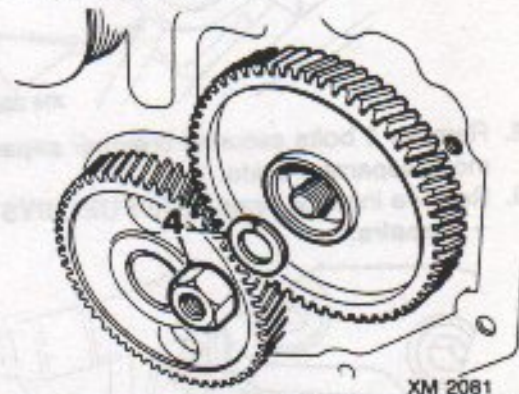
Service Repair No. 12.10.25

### Remove

1. Remove timing cover.



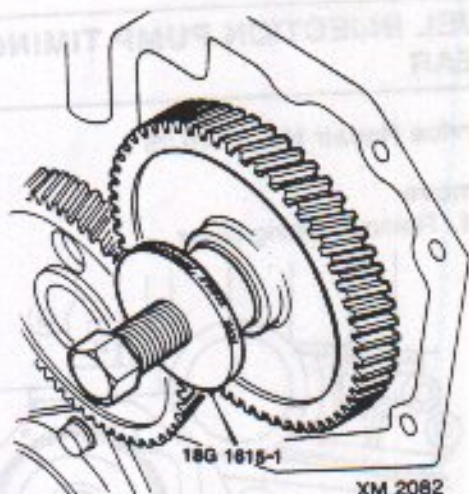
2. Fit but do not tighten crankshaft pulley nut.
3. Turn crankshaft clockwise until timing marks on gears are aligned.



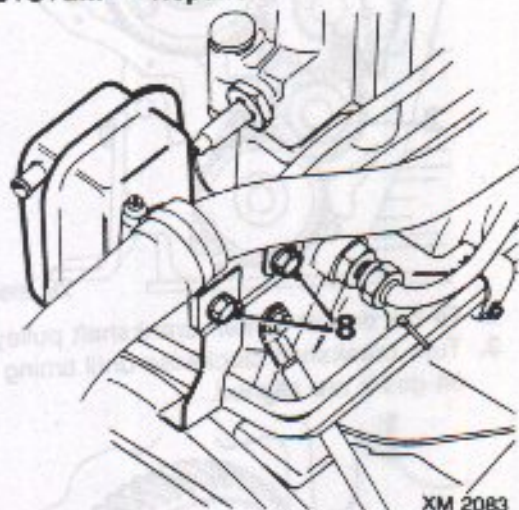
4. Remove nut securing injection pump timing gear; recover washer.

- Note:** Ensure timing marks are still aligned.
5. Remove tool 18G 1615 - 1 from tool 18G 1615.

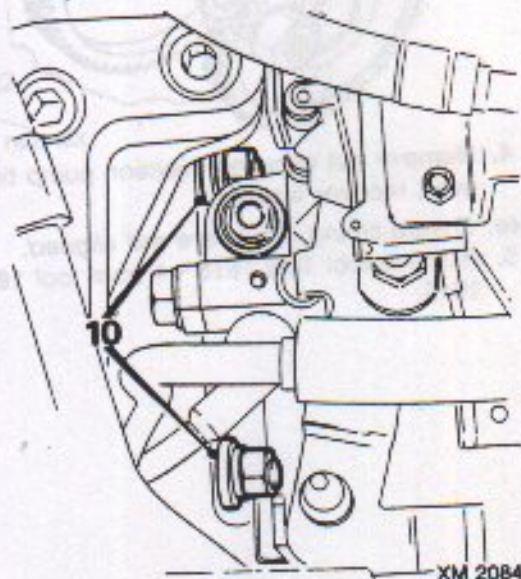




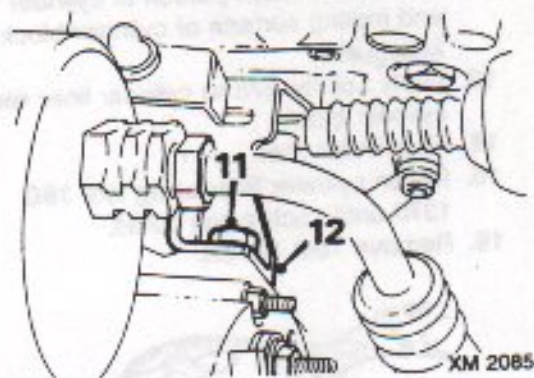
6. Fit tool 18G 1615 - 1 to injection pump timing gear.
7. Remove air cleaner assembly, see **FUEL SYSTEM - Repairs**.



8. Remove 2 bolts securing breather separator; move separator aside.
9. Remove injector pipes, see **FUEL SYSTEM - Repairs**.



10. Remove 3 nuts securing injection pump.



11. Remove bolt securing injection pump support bracket.
12. Remove support bracket.
13. Tighten centre screw of tool 18G 1615 - 1 and release injection pump timing gear from pump drive shaft.
14. Remove injection pump timing gear and tool 18G 1615 - 1.

**CAUTION:** Do not rotate engine with injection pump timing gear removed.

15. Remove tool 18G 1615 - 1 from injection pump timing gear.
16. Assemble tool 18G 1615 - 1 to 18G 1615.

### Refit

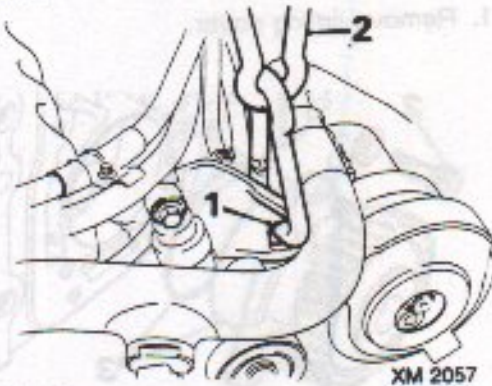
1. Clean injection pump timing gear and injection pump drive shaft.
2. Position injection pump to mounting studs.
3. Align Woodruff key on injection pump drive shaft to 11 o'clock position.
4. Position injection pump timing gear to injection pump drive shaft ensuring timing marks on gears are aligned.
5. Position injection pump support bracket.
6. Fit support bracket securing bolt and tighten to 25 Nm.
7. Fit but do not tighten 3 injection pump securing nuts.
8. Fit washer and nut securing injection pump timing gear tighten nut to 88 Nm.
9. Remove crankshaft pulley nut.
10. Fit timing cover.
11. Adjust injection pump timing, see **FUEL SYSTEM - Adjustments**



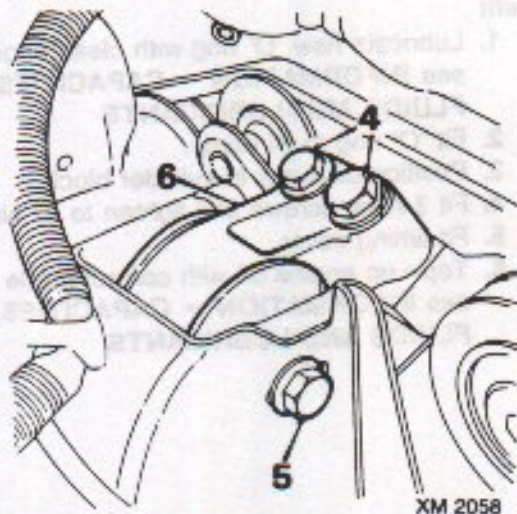
## RIGHT HAND ENGINE MOUNTING

Service Repair No. 12.45.12

### Remove



1. Fit lifting eye to power steering pump bracket.
2. Attach chains to lifting eye.
3. Raise chains to just support weight of engine.



4. Remove 2 bolts securing R.H. mounting to engine.
5. Remove bolt securing R.H. mounting to body; recover special nut.
6. Remove R.H. mounting; recover 2 snubbers.

### Refit

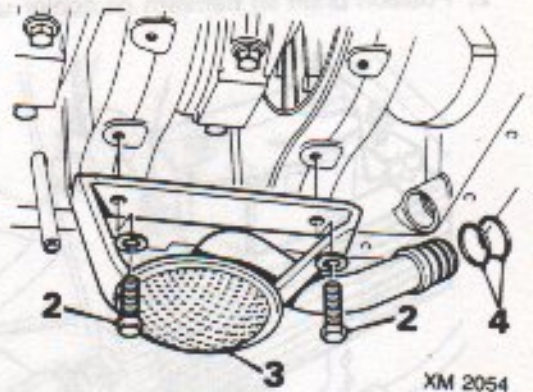
1. Position 2 snubbers to R.H. mounting.
2. Position R.H. mounting to engine, fit but do not tighten 2 bolts, R H. mounting to engine.
3. Align R.H. mounting to body fit bolt and special washer; tighten bolt to 45 Nm.
4. Tighten 2 R.H. mounting to engine bolts to 75 Nm.
5. Lower lifting chains, remove lifting eye.

## OIL PICK - UP STRAINER

Service Repair No. 12.60.20

### Remove

1. Remove engine sump. See **Engine Sump Gasket**.



2. Remove 2 bolts securing strainer to cylinder block.
3. Remove strainer.
4. Discard 2 'O' rings from oil pick - up pipe.

### Refit

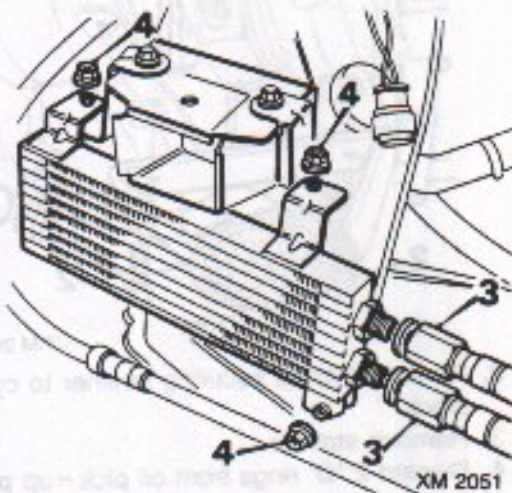
1. Ensure strainer and mating faces are clean.
2. Lubricate new 'O' rings with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
3. Fit 'O' rings to oil pick - up pipe.
4. Fit strainer, fit 2 bolts and tighten to 25 Nm.
5. Fit engine sump - see **Engine Sump Gasket**.

## OIL COOLER

Service Repair No. 12.60.68

### Remove

1. Remove front bumper, see **BODY - REPAIR MANUAL - Repairs**.
2. Position drain tin beneath oil cooler unions.



3. Disconnect feed and return pipe unions from oil cooler.

**CAUTION:** Plug open connections to prevent ingress of dirt.

4. Remove 3 nuts securing oil cooler; remove cooler.

### Refit

1. Position oil cooler to mounting studs.
2. Fit 3 nuts and tighten to 25 Nm.
3. Remove plugs; connect feed and return pipe unions; tighten unions to 30 Nm.

**Note:** Ensure pipes are routed in a natural curve.

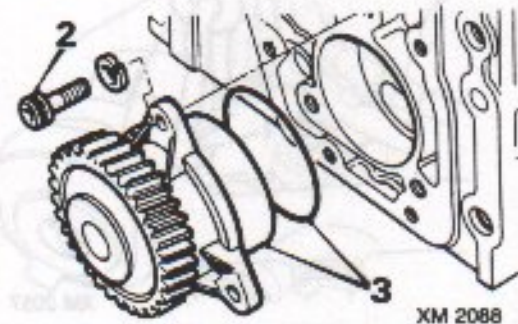
4. Fit front bumper, see **BODY - REPAIR MANUAL - Repairs**
5. Top - up engine oil with correct grade of oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**

## OIL PUMP

Service Repair No. 12.60.26

### Remove

1. Remove timing cover.



2. Remove 3 Allen screws, oil pump to cylinder block.
3. Withdraw oil pump; discard 'O' ring.

### Refit

1. Lubricate new 'O' ring with clean engine oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**
2. Fit 'O' ring to oil pump.
3. Position oil pump to cylinder block.
4. Fit 3 Allen screws and tighten to 27 Nm.
5. Fit timing cover.
6. Top - up engine oil with correct grade of oil, see **INFORMATION - CAPACITIES, FLUIDS AND LUBRICANTS**

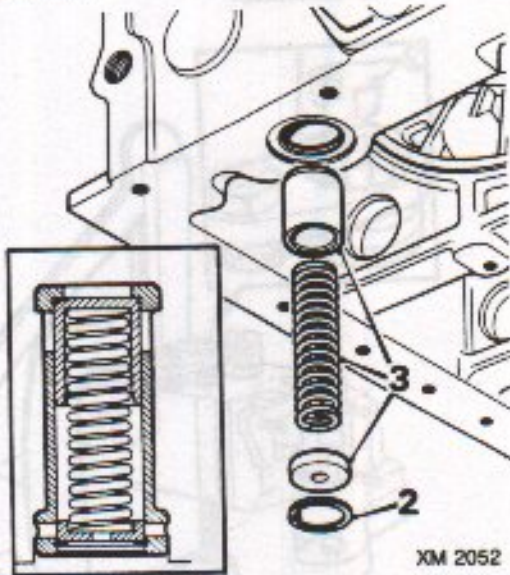


## OIL PRESSURE RELIEF VALVE

Service Repair No. 12.60.56

### Remove

1. Remove engine sump, see **Engine Sump Gasket**.



2. Remove circlip securing relief valve using tool **18G 257N**.
3. Remove relief valve cap, spring and plunger.
4. Check relief valve spring length.  
Relief valve spring free length = 57.5 mm

**Note:** If spring length is less than figure given or spring is distorted it must be renewed.

5. Check plunger for scoring; renew if necessary.

### Refit

1. Thoroughly clean all components and relief valve drilling in cylinder block.
2. Fit plunger, spring and cap.
3. Compress spring and fit circlip using tool **18G 257N**.

**CAUTION:** Ensure circlip is correctly seated in groove.

4. Fit engine sump - see **Engine Sump Gasket**.

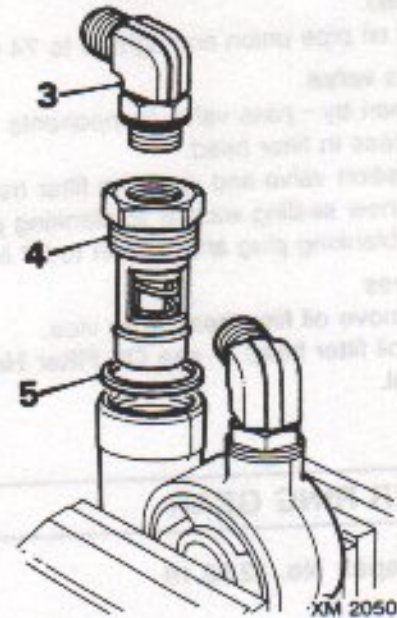
## OIL FILTER THERMOSTATIC AND BY-PASS VALVES

Service Repair No. Thermostatic valve - 12.60.17

Service Repair No. By-pass valve - 12.60.18

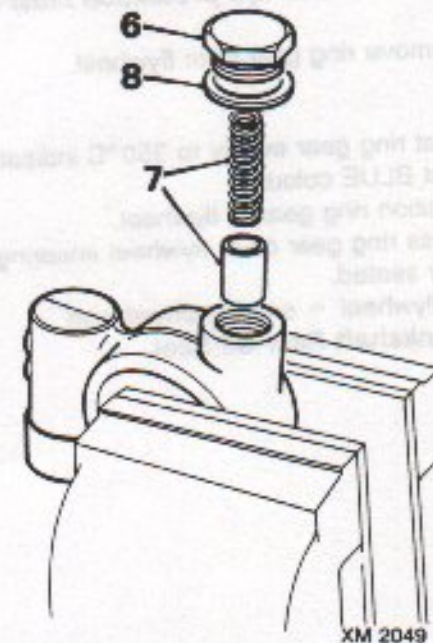
### Remove

1. Remove oil filter head - see **Oil Filter Head Seal**.
2. Secure oil filter head in soft jawed vice.



### Thermostatic valve

3. Remove oil pipe union.
4. Remove thermostatic valve.
5. Discard sealing washer.



### By-pass valve

6. Remove blanking plug.
7. Withdraw spring and by-pass valve.
8. Discard sealing washer.
9. Check spring for distortion and valve for damage; renew if necessary.

### Refit

#### Thermostatic valve

1. Clean thermostatic valve recess in filter head.

# ENGINE

2. Fit new sealing washer to valve.
3. Position valve and sealing washer in filter head.
4. Fit oil pipe union and tighten to 74 Nm.

## By-pass valve

5. Clean by-pass valve components and recess in filter head.
6. Position valve and spring in filter head.
7. Fit new sealing washer to blanking plug.
8. Fit blanking plug and tighten to 37 Nm.

## Both valves

9. Remove oil filter head from vice.
10. Fit oil filter head - see **Oil Filter Head Seal**.

## STARTER RING GEAR

Service Repair No. 12.53.19

### Remove

1. Remove flywheel - see **Flywheel and Crankshaft Rear Oil Seal**.
2. Drill a 4 mm dia. hole through ring gear.
3. Secure flywheel in a vice.
4. Using a cold chisel, split ring gear.

**WARNING: Suitable eye protection must be worn.**

5. Remove ring gear from flywheel.

### Refit

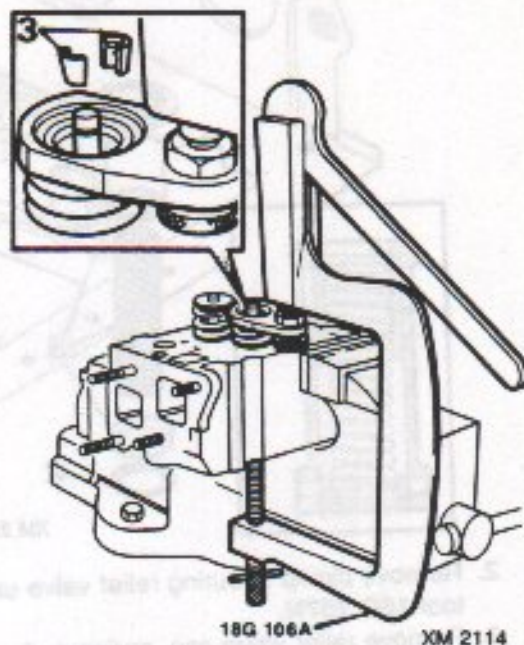
1. Heat ring gear evenly to 350°C indicated by light BLUE colour.
2. Position ring gear to flywheel.
3. Press ring gear on to flywheel ensuring it is fully seated.
4. Fit flywheel - see **Flywheel and Crankshaft Rear Oil Seal**.

## CYLINDER HEAD

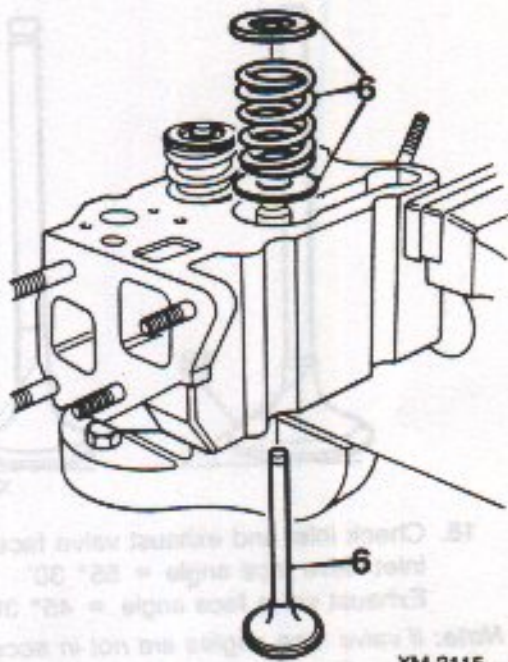
Service Repair No. 12.29.11

### Overhaul

1. Remove cylinder head(s) - see **Cylinder Head Gaskets**.



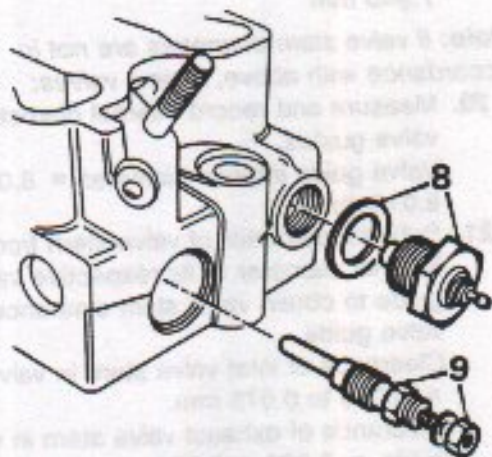
2. Position tool **18G 106A** to valve and valve spring.
3. Compress valve spring using tool **18G 106A**; remove 2 collets.
4. Release valve spring.
5. Remove tool **18G 106A**.



XM 2115

6. Remove valve, spring, spring cap and spring seat; discard valve spring.
7. Remove remaining valves.

**Note:** Keep components in their fitted order.



XM 2116

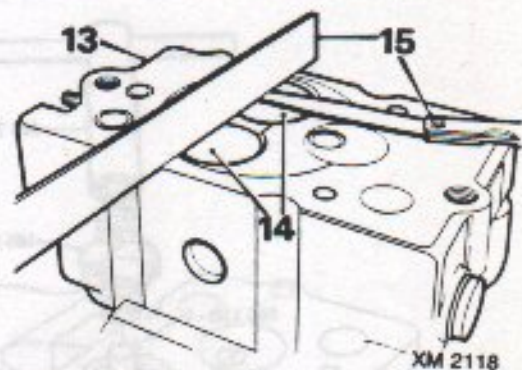
8. Remove coolant temperature gauge transmitter; discard sealing washer.
9. Remove 3 terminal nuts, disconnect wiring harness; remove 4 glow plugs.
10. Thoroughly clean and decarbonise cylinder head.
11. Decarbonise valves.



XM 2117

12. Using a straight edge, check cylinder head faces for warping or distortion; cylinder heads may be machined provided that minimum thickness is not exceeded. Cylinder head minimum thickness = 89.95 mm

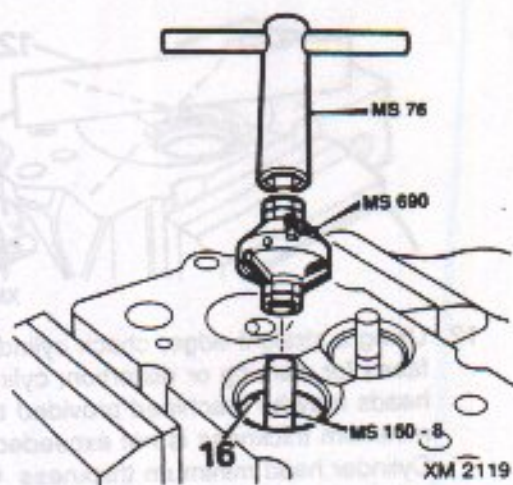
**CAUTION:** If only one cylinder head is found to be distorted and requires machining, it will also be necessary to machine remaining cylinder heads and end plates by a corresponding amount to maintain correct cylinder head alignment.



XM 2118

13. Invert cylinder head.
14. Fit each valve to its respective valve guide.
15. Using a straight edge and feeler gauges, check valve head stand down:  
Inlet valve head stand down = 0.80 to 1.20 mm  
Exhaust valve head stand down = 0.79 to 1.19 mm

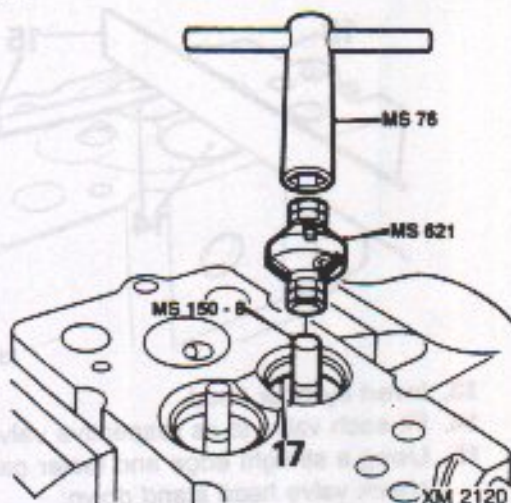
**Note:** If valve head stand down is not in accordance with above, discard original valves, check stand down with new valves fitted and re-cut valve seat inserts to obtain correct stand down.



16. Cut inlet valve seat insert faces if necessary using tools **MS 150-8**, **MS 76** and **MS 690**.

Inlet valve seat insert face angle =  $54^{\circ}30'$

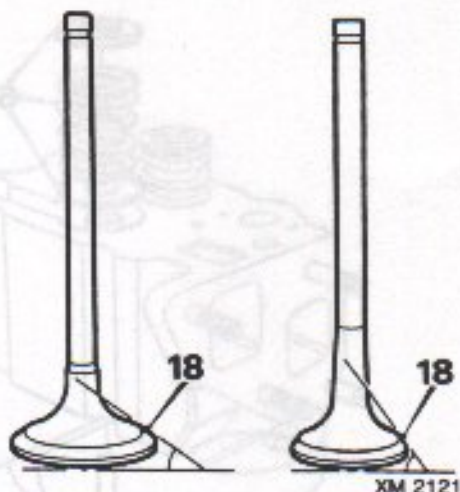
Inlet valve seat insert width = 1.8 to 2.2 mm.



17. Cut exhaust valve seat insert faces if necessary using tools **MS 150-8**, **MS 76** and **MS 621**.

Exhaust valve seat insert face angle =  $44^{\circ}30'$

Exhaust valve seat insert width = 1.65 to 2.05 mm



18. Check inlet and exhaust valve face angles:  
Inlet valve face angle =  $55^{\circ}30'$   
Exhaust valve face angle =  $45^{\circ}30'$

**Note:** If valve face angles are not in accordance with above, fit new valves.

19. Measure and record diameter of each valve stem:

Inlet valve stem diameter = 7.940 to 7.960 mm

Exhaust valve stem diameter = 7.920 to 7.940 mm

**Note:** If valve stem diameters are not in accordance with above, fit new valves:

20. Measure and record internal diameter of valve guides.

Valve guide internal diameter = 8.0 to 8.015 mm

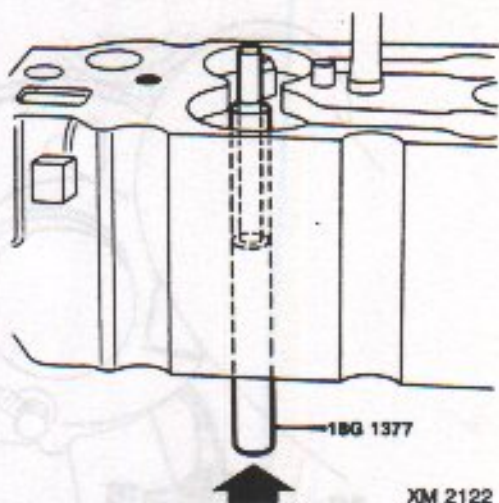
21. Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide.

Clearance of inlet valve stem in valve guide = 0.040 to 0.075 mm.

Clearance of exhaust valve stem in valve guide = 0.060 to 0.095.

**Note:** If valve stem clearance in valve guide exceeds above, new valve guide must be fitted.

22. Heat cylinder head uniformly to  $90^{\circ}\text{C}$ .



23. Position tool **18G 1377** to valve guide and press guide out through top of cylinder head.
24. Re-heat cylinder head to 90°C.
25. Position valve guide to top of cylinder head with chamfer on valve guide facing upwards.
26. Press valve guide into cylinder head using tool **18G 1377** until top of valve guide protrudes above cylinder head for a distance of:  
Valve guide height above spring seat counterbore = 13.5 to 14.00 mm.
27. Remove tool **18G 1377**, allow cylinder head to cool naturally.
28. Grind valves to their respective seats.
29. Remove all traces of grinding compound.
30. Assemble valve, spring seat, spring and spring cap to cylinder head.
31. Lubricate components with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
32. Position tool **18G 106A** to valve and valve spring.
33. Compress valve spring using tool **18G 106A**; fit 2 collets.
34. Remove tool **18G 106A**.
35. Fit remaining valves.
36. Fit coolant temperature gauge transmitter; use a new sealing washer.
37. Fit 4 glow plugs, connect harness and secure with 3 nuts.
38. Fit cylinder head(s) - see **Cylinder Head Gaskets**.

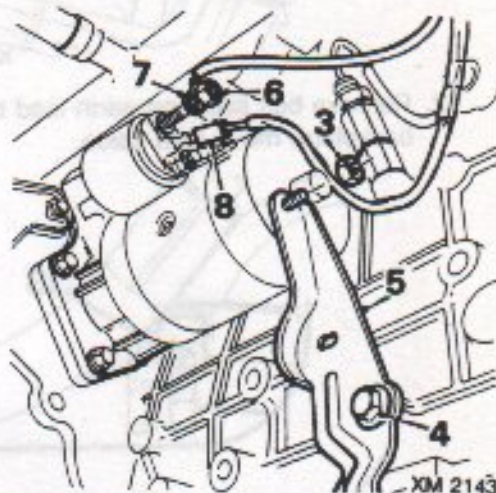
## CRANKSHAFT AND MAIN BEARINGS

Service Repair No. Crankshaft - 12.21.33

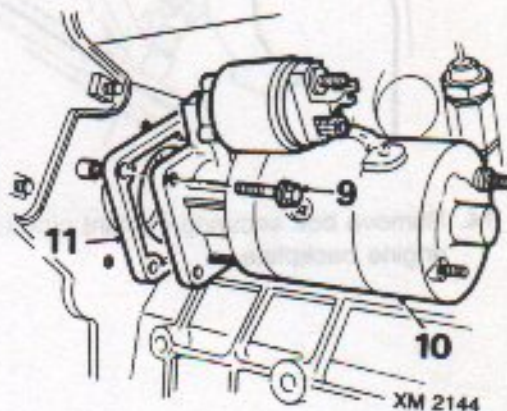
Service Repair No. Main bearings - 12.21.50

### Remove

1. Remove engine and gearbox assembly.
2. Remove flywheel - see **Flywheel and Crankshaft Rear Oil Seal**.

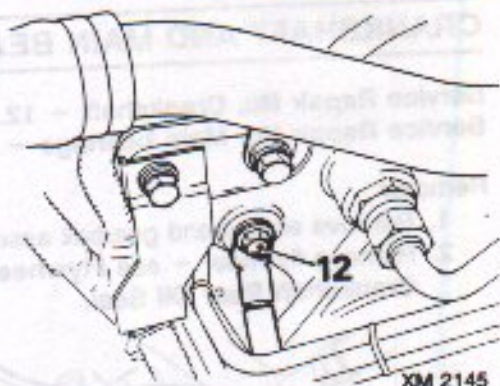


3. Remove nut securing starter motor support bracket to starter motor.
4. Remove bolt securing support bracket to cylinder block.
5. Remove bracket.
6. Remove starter solenoid terminal nut.
7. Release lead from terminal stud.
8. Disconnect starter solenoid Lucar.

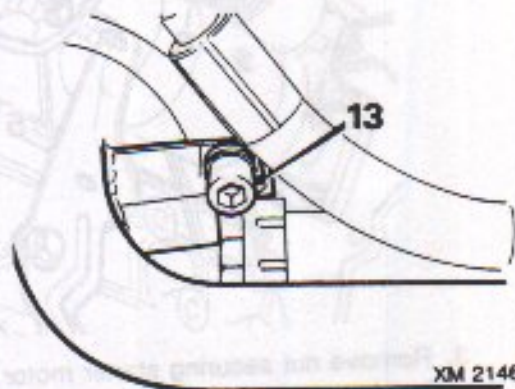


9. Remove 3 bolts securing starter motor to engine backplate.
10. Remove starter motor.
11. Remove spacer.

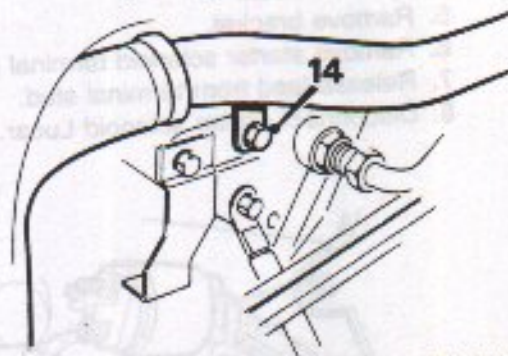




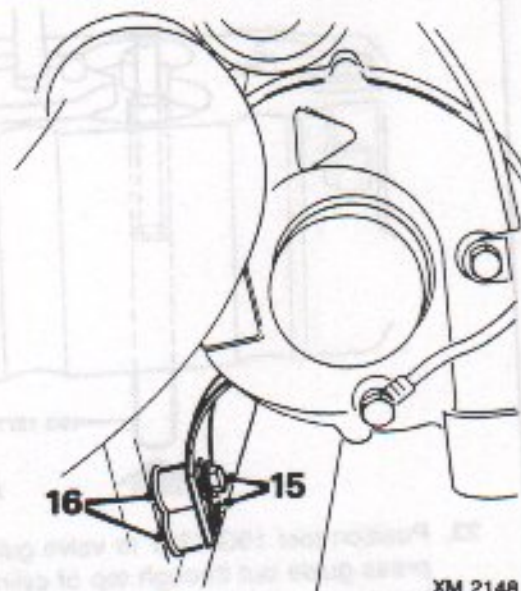
12. Remove bolt securing earth lead to engine backplate; move lead aside.



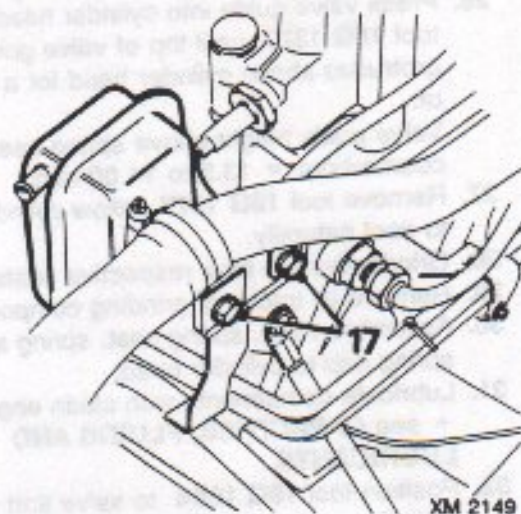
13. Remove Allen screw securing coolant pipe to turbocharger support bracket.



14. Remove bolt securing coolant pipe to engine backplate.

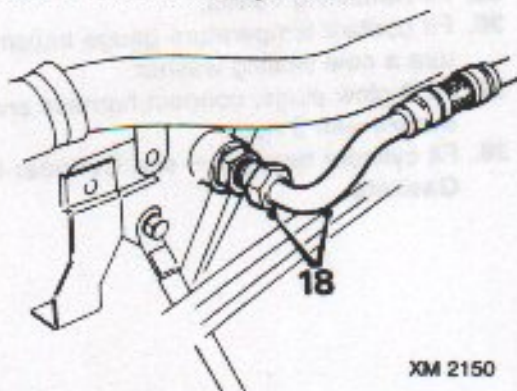


15. Remove 2 bolts securing turbocharger support bracket to engine backplate.  
16. Remove 2 spacers.

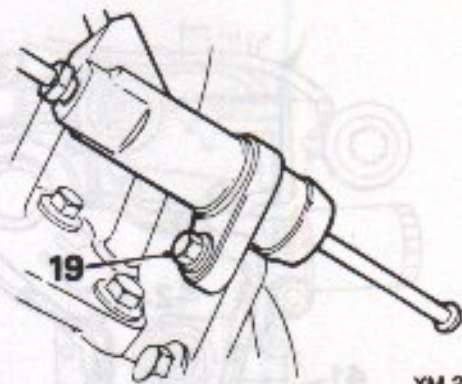


*Pre 1992 model illustrated.*

17. Remove 2 bolts securing oil separator and move oil separator aside. 1992 models on have a circular oil separator.

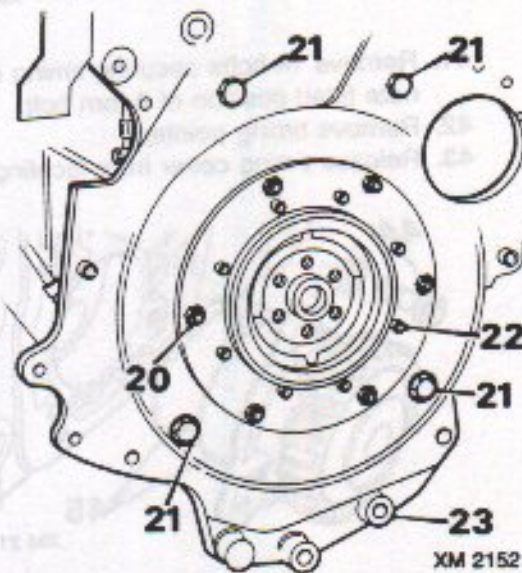


18. Disconnect turbocharger oil return hose union.



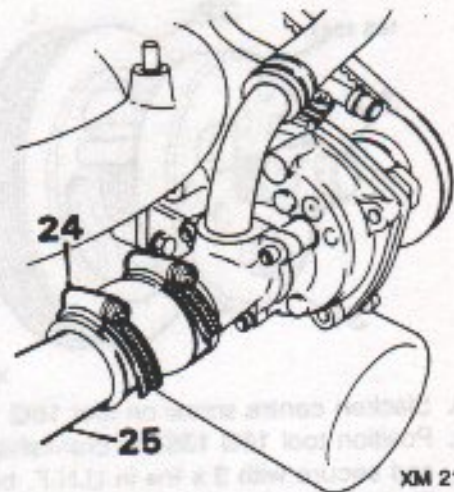
XM 2151

19. Remove bolt securing clutch slave cylinder; move cylinder aside.



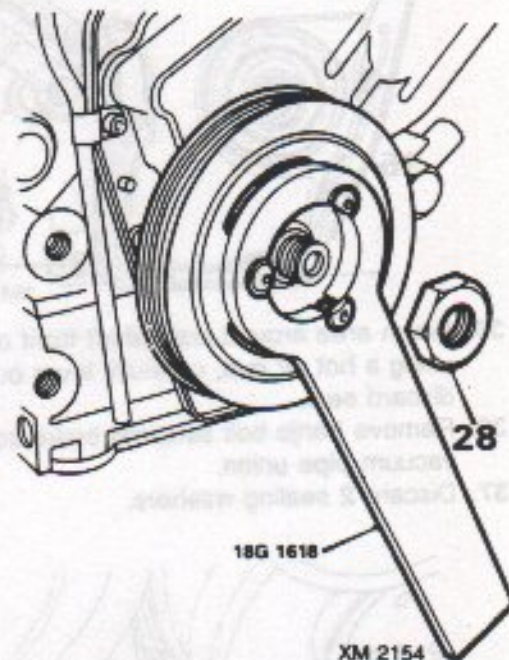
XM 2152

20. Remove 6 nuts securing engine backplate to cylinder block.  
 21. Remove 4 bolts securing engine backplate to cylinder block.  
 22. Remove 8 Allen screws securing engine backplate to rear main bearing carrier.  
 23. Remove engine backplate, discard 2 'O' rings.



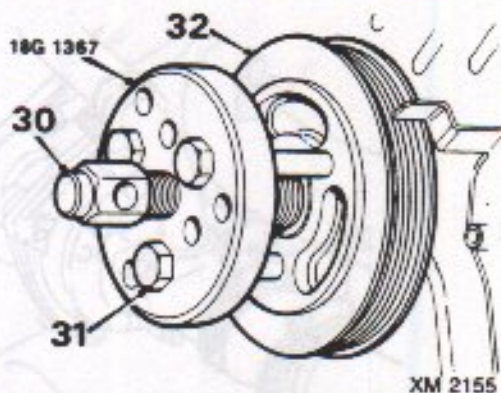
XM 2153

24. Slacken clip, disconnect coolant connecting pipe from coolant pump inlet adaptor.  
 25. Remove coolant connecting pipe.  
 26. Remove cylinder heads - see Cylinder Head Gaskets.

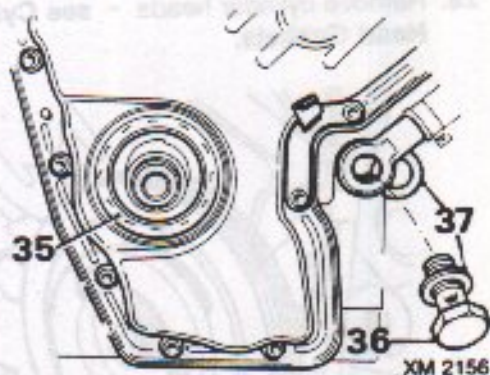


XM 2154

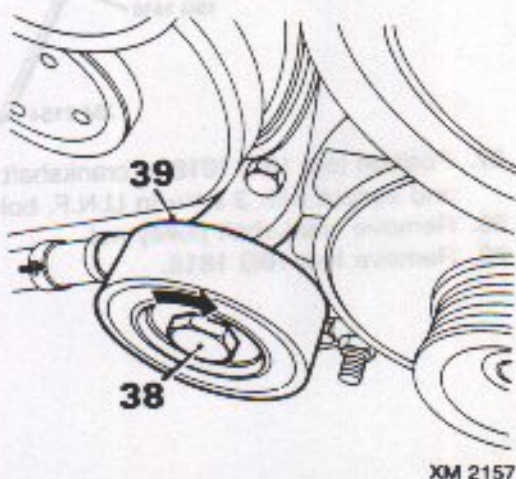
27. Position tool 18G 1618 to crankshaft pulley and secure with 3 x 5/16 in U.N.F. bolts.  
 28. Remove crankshaft pulley nut.  
 29. Remove tool 18G 1618.



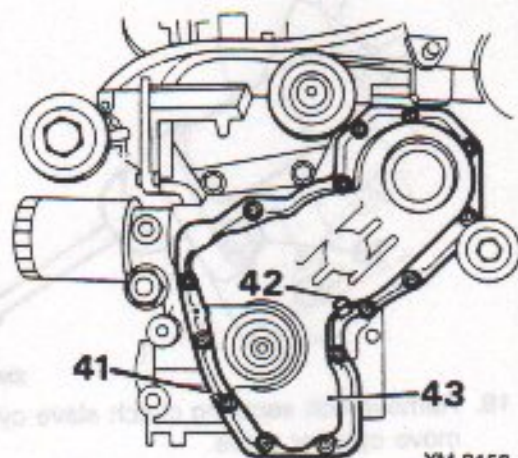
30. Slacken centre screw on tool **18G 1367**.
31. Position tool **18G 1367** to crankshaft pulley and secure with 3 x 3/16 in U.N.F. bolts.
32. Tighten centre screw on tool **18G 1367** to release crankshaft pulley.
33. Remove tool **18G 1367**.
34. Remove crankshaft pulley.



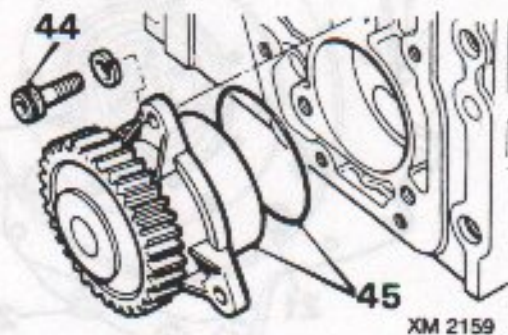
35. Warm area around crankshaft front oil seal using a hot air gun, carefully lever out seal; discard seal.
36. Remove banjo bolt securing brake servo vacuum pipe union.
37. Discard 2 sealing washers.



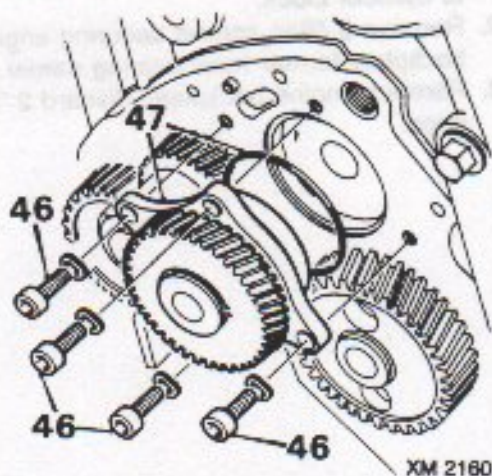
38. Remove upper jockey pulley securing bolt.
- Note:** Bolt has a L.H. thread.
39. Remove upper jockey pulley.
  40. Remove auxiliary drive belt tensioner - see **ELECTRICAL - Repairs**.



41. Remove 14 bolts securing timing cover, note fitted position of 8 mm bolt.
42. Remove timing pointer.
43. Release timing cover from locating dowels.

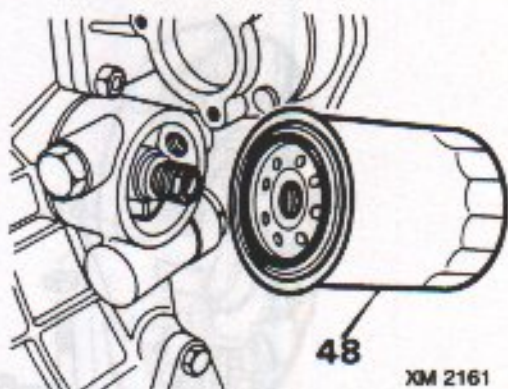


44. Remove 3 Allen screws securing oil pump to cylinder block.
45. Withdraw oil pump; discard 'O' ring.

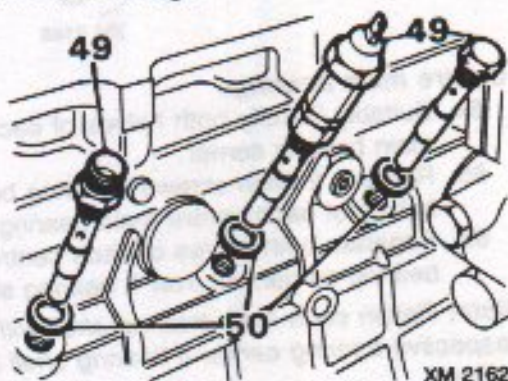


46. Remove 4 Allen screws securing brake servo vacuum pump; remove 4 wave washers.

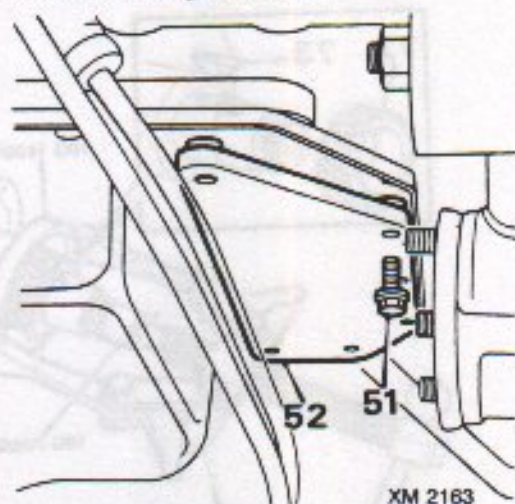
- Note:** Allen screw fitted nearest to crankshaft gear has smaller diameter head than other 3 screws.
47. Remove brake servo vacuum pump; discard 'O' ring.



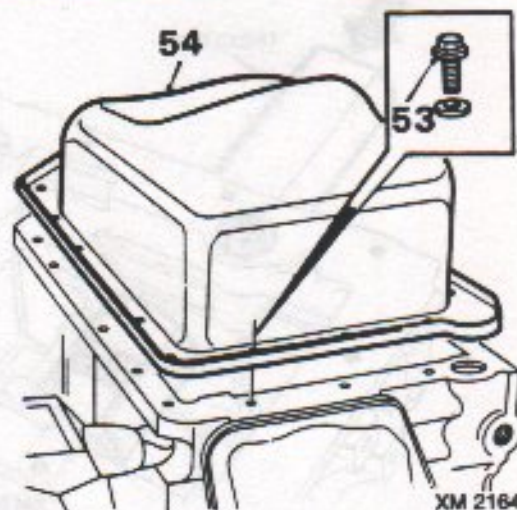
48. Unscrew oil filter cartridge from filter head, discard cartridge.



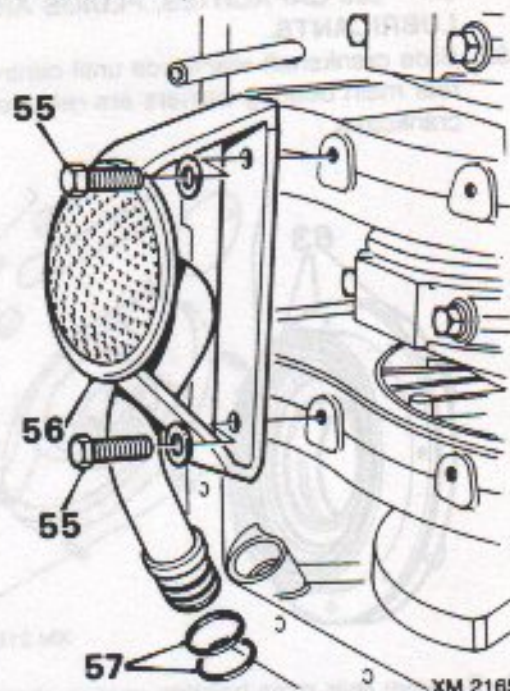
49. From L.H. side of cylinder block, remove 3 main bearing oil feed and carrier location dowels.  
50. Discard 3 sealing washers.



51. Remove 6 bolts securing reinforcing plate.  
52. Remove reinforcing plate.



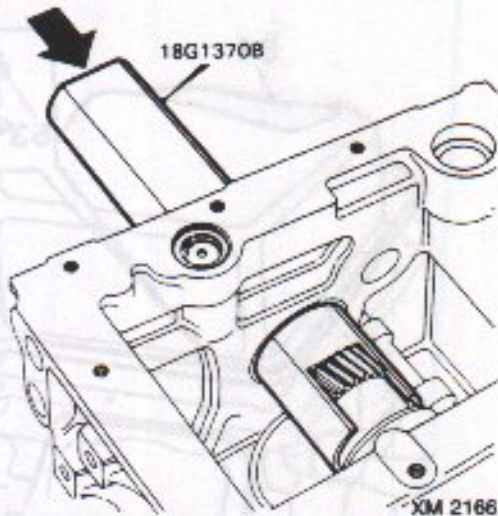
53. Remove 14 remaining bolts securing sump.  
54. Remove sump.



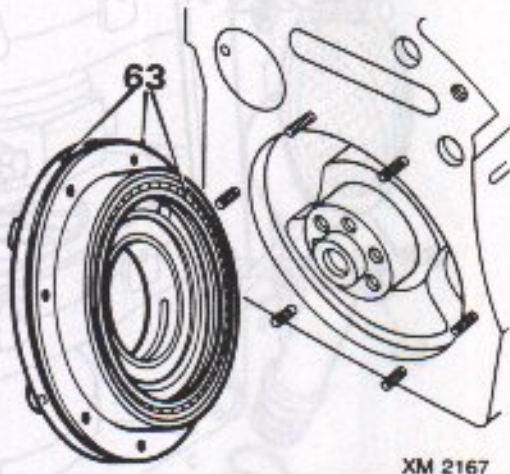
55. Remove 2 bolts securing oil pick-up strainer to cylinder block.  
56. Remove strainer.  
57. Discard 2 'O' rings from oil pick-up pipe.  
58. Remove pistons and connecting rods.

#### Crankshaft

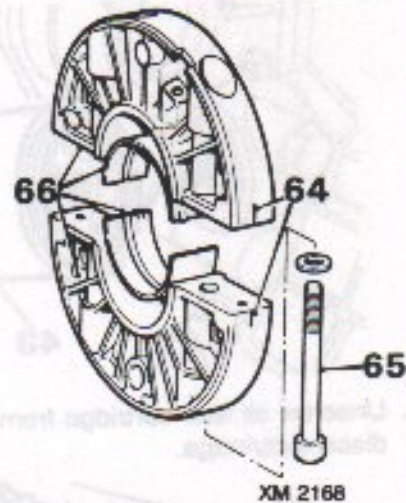
59. Clean tool 18G 1370B.



60. Fit tool **18G 1370B** to crankshaft.
61. Lubricate tool **18G 1370B** with clean engine oil – see **CAPACITIES, FLUIDS AND LUBRICANTS**.
62. Slide crankshaft rearwards until centre and rear main bearing carriers are released from crankcase.



63. Remove rear main bearing carrier; discard 'O' ring and crankshaft rear oil seal.

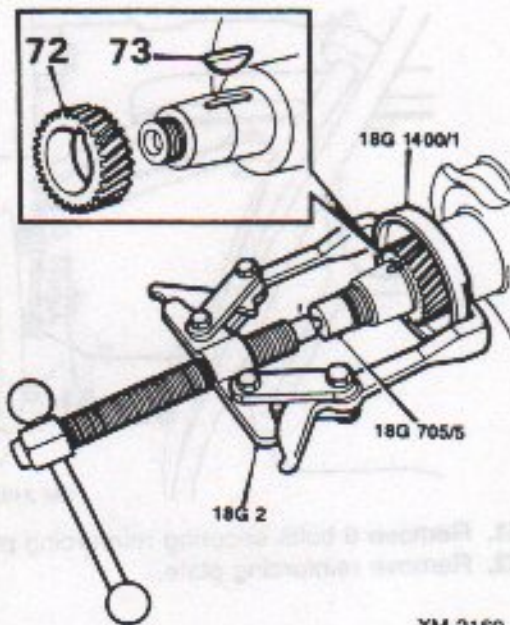


### Centre main bearings

64. Suitably identify both halves of each centre main bearing carrier.
65. Remove 2 Allen screws securing both halves of each centre main bearing carrier.
66. Separate both halves of each centre main bearing carrier; recover 6 bearing shells.

**Note:** Retain each main bearing shell with its respective bearing carrier if bearing shell is to be refitted.

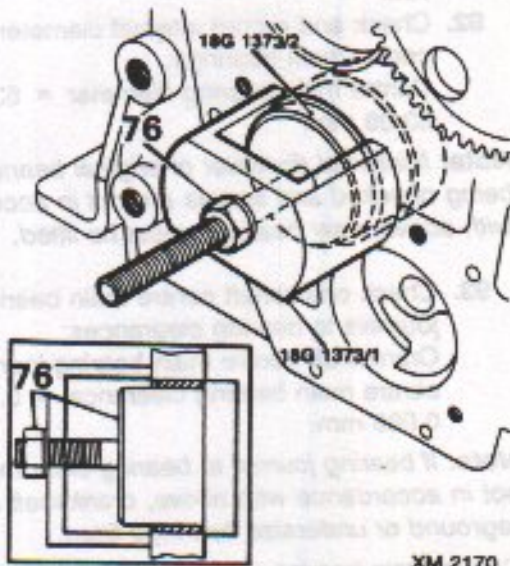
67. Move crankshaft rearwards until it can be withdrawn from crankcase.
68. Remove tool **18G 1370B**.



69. Position thrust button, tool **18G 705/5** to front end of crankshaft.
70. Fit adaptor, tool **18G 1400/1** to crankshaft gear.
71. Fit tool **18G 2** to **18G 1400/1**.
72. Tighten centre screw of tool **18G 2** and pull gear off crankshaft.
73. Remove Woodruff key.



74. Remove tools 18G 2, 18G 1400/1 and 18G 705/5.

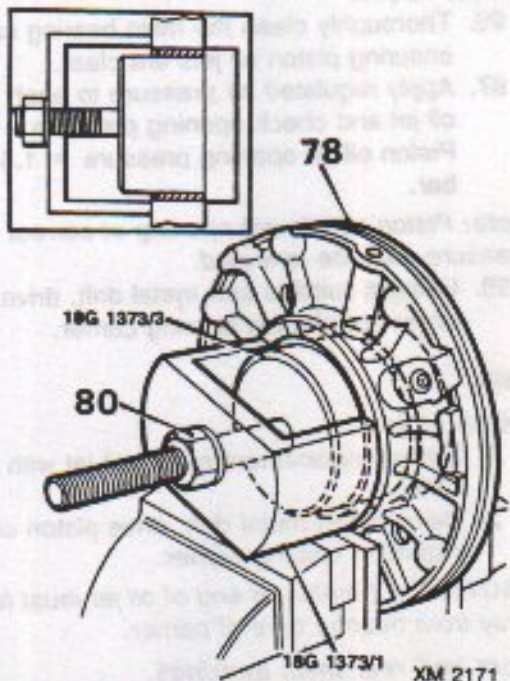


XM 2170

#### Front and rear main bearings

75. Position 18G 1373/1 and 18G 1373/2 to front main bearing.  
76. Tighten centre nut of tool 18G 1373/2 and withdraw front main bearing.  
77. Remove tools 18G 1373/1 and 18G 1373/2, discard bearing.

**CAUTION:** Once removed from cylinder block, front main bearing must be discarded and new bearing fitted.

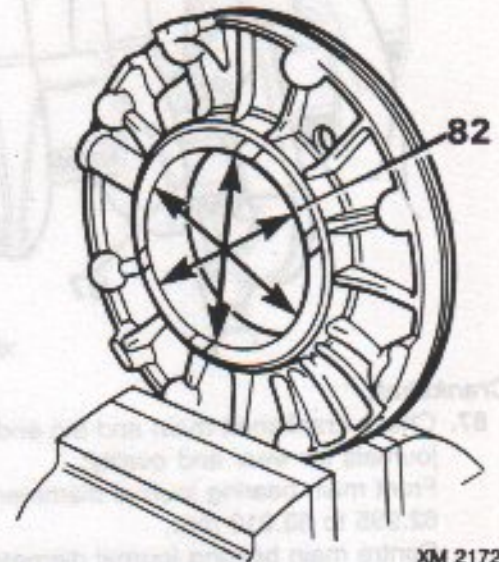


XM 2171

78. Secure rear main bearing carrier in a soft jawed vice.  
79. Position tools 18G 1373/1 and 18G 1373/3 to rear main bearing.  
80. Tighten centre nut of tool 18G 1373/3 and withdraw rear main bearing.

81. Remove tools 18G 1373/1 and 18G 1373/3 discard bearing.

**Note:** Once removed from bearing carrier, rear main bearing must be discarded.



XM 2172

82. Check internal diameters of front and rear main bearing carriers:  
Front main bearing carrier internal diameter = 67.025 to 67.050 mm.  
Rear main bearing carrier internal diameter = 75.005 to 75.030 mm.

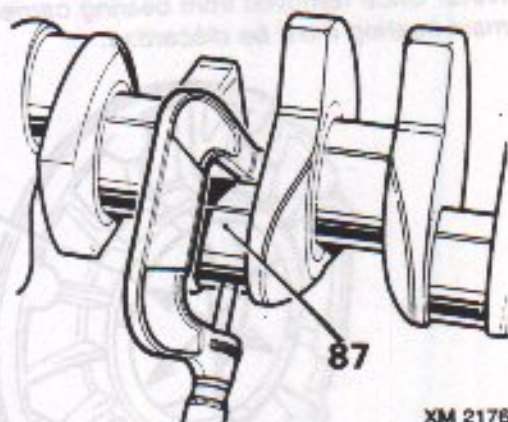
**Note:** If bearing carrier internal diameters are not in accordance with above, bearing carriers must be renewed.

#### Centre main bearing carriers

83. Assemble respective halves of each centre main bearing carrier.  
84. Fit 2 Allen screws to each centre main bearing carrier and tighten each screw to 54 Nm.  
85. Check internal diameter of each centre main bearing carrier:  
Centre main bearing carrier internal diameter = 66.67 to 66.68 mm.

**Note:** If bearing carrier internal diameters are not in accordance with above, bearing carriers must be renewed.

86. Remove Allen screws; separate bearing carrier halves.



## Crankshaft

87. Check crankshaft main and big end bearing journals for wear and ovality:
- Front main bearing journal diameter = 62.995 to 63.010 mm.
  - Centre main bearing journal diameter = 63.005 to 63.020 mm.
  - Rear main bearing journal diameter = 69.985 to 70.00 mm.
  - Big end bearing journal diameter = 53.84 to 53.955 mm.

If necessary, crankshaft may be reground to a minimum diameter of:

- Front main bearing journal = 62.745 mm.
- Centre main bearing journal = 62.755 mm.
- Rear main bearing journal = 69.735 mm.
- Big end bearing journal = 53.69 mm.

Fillet radii must be restored after crankshaft has been reground.

## Bearing clearance check

88. Check crankshaft main bearing journal to front and rear main bearings clearance.

**Note:** If front and rear main bearings have been removed from crankcase or rear bearing carrier, clearance must be checked against new bearings.

- Front main bearing journal to bearing clearance = 0.050 to 0.115 mm.
- Front main bearing internal diameter = 63.060 to 63.11 mm.
- Rear main bearing journal to bearing clearance = 0.040 to 0.070 mm.
- Rear main bearing internal diameter = 70.050 to 70.065 mm.

**Note:** If bearing journal to bearing clearances are not in accordance with above, crankshaft must be reground or undersize bearings fitted.

Front and rear main bearing undersize available = 0.25 mm.

89. Fit centre main bearings to upper and lower halves of main bearing carriers.
90. Assemble respective halves of each centre main bearing carrier.

91. Fit 2 Allen screws to each centre main bearing carrier and tighten each screw to 42 Nm.

92. Check and record internal diameter of centre main bearings:  
Centre main bearing diameter = 63.050 to 63.09 mm.

**Note:** If internal diameter of original bearings is being checked and figures are not in accordance with above, new bearings must be fitted.

93. Check crankshaft centre main bearing journals to bearing clearances:  
Crankshaft centre main bearing journal to centre main bearing clearance = 0.03 to 0.088 mm.

**Note:** If bearing journal to bearing clearances are not in accordance with above, crankshaft must be reground or undersize bearings fitted.

Centre main bearing undersize available = 0.25 mm.

94. Remove Allen screws; separate main bearing carrier halves and remove main bearings.

**Note:** Keep each main bearing with its respective main bearing carrier.

95. Check big end bearing journals to big end bearing clearances – see **Pistons and Connecting Rods**.

## Piston oil jets

96. Thoroughly clean the main bearing carriers ensuring piston oil jets are clear.
97. Apply regulated air pressure to each piston oil jet and check opening pressure:  
Piston oil jet opening pressure = 1.5 to 1.9 bar.

**Note:** Piston oil jets not opening at correct pressure must be renewed.

98. Using a suitable soft metal drift, drive piston oil jet out of main bearing carrier.

## Refit

### Piston oil jets

1. Smear replacement piston oil jet with Loctite AVX.
2. Using a soft metal drift, drive piston oil jet into main bearing carrier.

**CAUTION:** Chamfer on end of oil jet must face away from bearing bore of carrier.

### Front and rear main bearings.

3. Position new front main bearing to tool 18G 1373/2.
4. Position tool 18G 1373/2 and front main bearing to cylinder block ensuring oil holes in bearing and cylinder block are aligned.
5. Fit tool 18G 1373/1, to tool 18G 1373/2.
6. Tighten centre nut of tool 18G 1373/2 and pull front main bearing into cylinder block.



7. Remove tools **18G 1373/1** and **18G 1373/2**.
8. Secure rear main bearing carrier in a soft jawed vice.
9. Position new rear main bearing to tool **18G 1373/3**.
10. Position tool **18G 1373/3** and rear main bearing to rear main bearing carrier ensuring that oil holes in bearing and carrier are aligned.
11. Fit tool **18G 1373/1** to tool **18G 1373/3**.
12. Tighten centre nut of tool **18G 1373/3** and pull rear main bearing into rear main bearing carrier.
13. Remove tools **18G 1373/1** and **18G 1373/3**.
14. Remove rear main bearing carrier from vice.
15. Lubricate a new 'O' ring with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**; fit 'O' ring to rear main bearing carrier.

#### **Crankshaft**

16. Thoroughly clear crankshaft; ensure all oil passageways are clear.
17. Clean crankshaft gear.
18. Position crankshaft to hand press.
19. Fit Woodruff key to keyway in crankshaft.
20. Position crankshaft gear to crankshaft ensuring keyway in gear is aligned with Woodruff key.
21. Press gear on to crankshaft.
22. Remove crankshaft from press.
23. Fit main bearings to centre main bearing carriers ensuring oil holes in bearing and carrier are aligned.
24. Lubricate crankshaft, gear and main bearings with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
25. Lubricate tool **18G 1370B** with clean engine oil.
26. Position tool **18G 1370B** to front main bearing.
27. Position crankshaft in crankcase, ensure tool **18G 1370B** covers crankshaft gear.
28. Assemble 3 centre main bearing carriers to their respective crankshaft main bearing journals.

**CAUTION:** Ensure reference marks are aligned.

29. Fit Allen screws to each main bearing carrier; tighten screws to 42 Nm.
30. Move crankshaft forward and using assistance, insert centre main bearing carriers into crankcase ensuring arrow on each main bearing carrier aligns with vertical web in centre of crankcase.
31. Fit new sealing washers to 3 main bearing feed and carrier location dowels.
32. Fit 3 main bearing feed and carrier location dowels ensuring they are correctly inserted into centre main bearing carriers.
33. Remove tool **18G 1370B**.

34. Connect Lucar to oil pressure switch.
35. Fit rear main bearing carrier to crankshaft ensuring arrow on bearing carrier aligns with vertical web in centre of crankcase.
36. Smear new crankshaft rear oil seal with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
37. Fit crankshaft rear oil seal using tool **18G 1374**.
38. Lubricate 2 new 'O' rings with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
39. Fit 2 'O' rings to grooves in engine backplate.
40. Position engine backplate to studs in cylinder block.
41. Fit 8 Allen screws securing engine backplate to rear main bearing carrier; tighten screws to 27 Nm.
42. Fit 4 nuts and 6 bolts securing engine backplate to cylinder block; tighten nuts and bolts to 47 Nm.
43. Lubricate a new 'O' ring with general purpose grease and fit to flywheel.
44. Position flywheel on crankshaft and align bolt holes.

**Note:** Do not fit crankshaft thrust washers at this stage.

45. Fit 2 flywheel securing bolts 180° apart and tighten to 108 Nm.
46. Attach tool **18G 191** to engine backplate, position stylus of tool to contact flywheel.
47. Move crankshaft towards front of engine.
48. Zero gauge of tool **18G 191**.
49. Move crankshaft towards rear of engine.
50. Record crankshaft end float indicated on gauge.
51. Subtract specified crankshaft end float from figure obtained:  
Crankshaft end float = 0.153 to 0.304 mm.
52. Select thrust washer which will give correct end float.  
Thrust washers available = 2.311 to 2.362 mm, 2.411 to 2.462 mm.
53. Remove tool **18G 191**; remove 2 bolts securing flywheel.
54. Smear thrust washer halves with general purpose grease and fit them to rear main bearing carrier.
55. Fit flywheel, tighten bolts to 108 Nm.
56. Fit pistons and connecting rods.
57. Lubricate 2 new 'O' rings with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**; fit 'O' rings to oil pick-up pipe.
58. Fit oil strainer and pick-up pipe.
59. Fit 2 bolts and tighten to 25 Nm.
60. Clean sealant from sump flange and cylinder block.
61. Apply RTV to sump joint face.



62. Position sump and fit 14 bolts finger tight.
63. Position reinforcing plate, fit 6 bolts and tighten to 11 Nm.
64. Tighten 14 sump bolts by diagonal selection to 11 Nm.
65. Move engine to upright position.

**CAUTION:** Do not allow weight of engine to rest on sump.

66. Check that timing marks on camshaft and fuel injection pump gears are aligned.
67. Fit but do not tighten crankshaft pulley nut.
68. Turn crankshaft until timing mark on gear is at 12 o'clock position.
69. Lubricate a new 'O' ring with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS** ; fit 'O' ring to brake servo vacuum pump.
70. Position brake servo vacuum pump to engine, rotate vacuum pump, camshaft and crankshaft gears to align timing marks.
71. Fit 4 Allen screws and wave washers to secure brake servo vacuum pump; tighten screws to 27 Nm.

**Note:** Allen screw with small diameter head must be fitted nearest to crankshaft gear.

72. Lubricate a new 'O' ring with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
73. Fit 'O' ring to oil pump.
74. Fit oil pump, fit 3 Allen screws and tighten to 27 Nm.
75. Remove crankshaft pulley nut.
76. Clean sealant from mating faces of cylinder block and timing cover; clean timing cover.
77. Apply a 3 to 6 mm bead of sealant to timing cover.
78. Locate timing cover on dowels.
79. Position timing pointer on timing cover.
80. Fit 13 6 mm screws and 8 mm screw, tighten to:
  - 6 mm screws 10 Nm.
  - 8 mm screw 25 Nm.
81. Clean servo banjo bolt.
82. Position new sealing washers, fit and tighten servo banjo bolt to 40 Nm.
83. Fit auxiliary drive belt tensioner - see **ELECTRICAL - Repairs**.
84. Fit upper jockey pulley; fit and tighten bolt.

**Note:** Bolt has a L.H. thread.

85. Lubricate new timing cover oil seal with clean engine oil - see **CAPACITIES, FLUIDS AND LUBRICANTS**.
86. Fit timing cover oil seal using tools 18G 1068 and 18G 1619
87. Fit crankshaft pulley.
88. Clean old Loctite from threads of crankshaft pulley nut.
89. Apply Loctite 601 to crankshaft pulley nut thread and fit nut.

90. Fit tool 18G 1618 to crankshaft pulley and secure with 3 x 5/16 in U.N.F. bolts.
91. Tighten crankshaft pulley nut to 177 Nm.
92. Remove tool 18G 1618.
93. Fit cylinder heads - see **Cylinder Head Gaskets**.
94. Fit a new oil filter cartridge.
95. Connect coolant connecting pipe to coolant pump inlet adaptor; position and tighten clip.
96. Position clutch slave cylinder to engine backplate.
97. Fit bolt and tighten to 22 Nm.
98. Fit turbocharger oil return hose union.
99. Fit engine breather separator; fit 2 bolts and tighten to 25 Nm.
100. Fit 2 spacers and 2 bolts, turbocharger support bracket to engine backplate ; tighten bolts to 27 Nm.
101. Position coolant pipe to engine backplate and turbocharger support bracket; fit and tighten bolt and Allen screw.
102. Position earth lead to engine backplate; fit and tighten bolt.
103. Fit spacer and starter motor, ensure spacer locates on dowel.
104. Fit 3 bolts and tighten to 68 Nm.
105. Connect lead to solenoid terminal; fit and tighten nut.
106. Connect solenoid Lucar.
107. Position starter motor support bracket.
108. Fit and tighten bolt, support bracket to cylinder block.
109. Fit and tighten nut, support bracket to starter motor.
110. Fit clutch driven plate - see **CLUTCH - Repairs**.
111. Fit engine and gearbox assembly assembly.
112. Check fuel injection pump timing - see **FUEL SYSTEM - Adjustments**.

**DATA****Crankshaft**

Front main journal Diameter .....	62.995 to 63.010 mm
Clearance in main bearing .....	0.050 to 0.115 mm
Minimum regrind diameter .....	62.745 mm
Central main journal diameter .....	63.005 to 63.020 mm
Clearance in main bearing .....	0.03 to 0.088 mm
Minimum regrind diameter .....	62.755 mm
Rear main journal diameter .....	69.985 to 70.00 mm
Clearance in main bearing .....	0.040 to 0.070 mm
Minimum regrind diameter .....	69.735 mm
Crankpin journal diameter .....	53.84 to 53.955 mm
Clearance in big end bearing .....	0.022 to 0.076 mm
Minimum regrind diameter .....	53.69 mm
End float .....	0.153 to 0.304 mm
Adjustment .....	Thrust washers
Thrust washers available .....	2.311 to 2.362 mm
	2.411 to 2.462 mm
	2.511 to 2.562 mm

**Main bearings**

## Standard

## Internal diameter:

Front .....	63.060 to 63.11 mm
Centre .....	63.050 to 63.09
Rear .....	70.050 to 70.065
Bearing undersizes .....	0.25 mm less than the dimensions given

**Main bearing carriers**

## Internal diameter:

Front .....	67.025 to 67.050 mm
Centre .....	66.67 to 66.68 mm
Rear .....	75.005 to 75.030 mm
Piston oil jet opening pressure .....	1.5 to 1.9 bar

**Cylinder liners**

## Internal diameter:

Grade 'A' - No identification mark .....	92.000 to 92.010 mm
Grade 'B' - Identified by a notch machined in bottom edge of liner .....	92.010 to 92.020 mm
Protrusion .....	0.01 to 0.06 mm
Adjustment .....	Shims
Shims available .....	0.15 mm
	0.20 mm
	0.23 mm

Maximum ovality .....	0.100 mm
Maximum taper .....	0.100 mm

**Cylinder heads**

Minimum thickness .....	89.95 to 90.05 mm
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### Pistons Skirt diameter

measured at approximately 15 mm above the bottom of the skirt)

Grade A .....	91.92 to 91.93 mm
Grade B .....	91.93 to 91.94 mm
Piston skirt wear limit .....	0.05 mm
Maximum ovality of gudgeon pin bore .....	0.05 mm
Piston clearance:	
Top of piston to cylinder head .....	0.95 to 1.04 mm
Piston protrusion above crankcase:	
Fit gasket with 0 notches	
when protrusion is .....	0.38 to 0.47 mm
Fit gasket with 2 notches	
when protrusion is .....	0.48 to 0.57 mm
Fit gasket with 1 notch	
when protrusion is .....	0.58 to 0.67 mm
Maximum piston to liner clearance .....	0.15 mm

### Piston Rings

Clearance in groove:

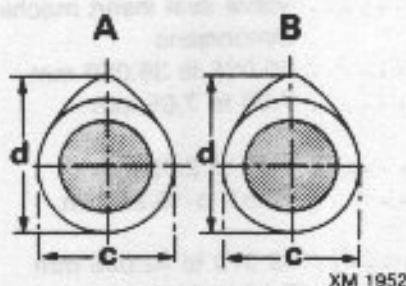
Top .....	0.080 to 0.130 mm
Second .....	0.070 to 0.102 mm
Oil control .....	0.040 to 0.072 mm
Fitted gap:	
Top .....	0.215 to 0.50 mm
Second .....	0.25 to 0.45 mm
Oil control .....	0.25 to 0.58 mm

### Gudgeon Pins

Type .....	Fully floating
Diameter .....	29.990 to 29.996 mm
Clearance in connecting rod .....	0.034 to 0.055 mm
Wear limit between gudgeon pin and	
connecting rod bush .....	0.100 mm

### Camshaft

Journal diameter - Front .....	53.495 to 53.51 mm
- Centre .....	53.45 to 53.47 mm
- Rear .....	53.48 to 53.50 mm
Bearing clearance - Front .....	0.030 to 0.095 mm
- Centre .....	0.07 to 0.14 mm
- Rear .....	0.04 to 0.11 mm



### Cam lobe minimum dimensions:

Inlet (A)	
Diameter (c) .....	38.5 mm
Height (d) .....	45.7 mm
Exhaust (B)	
Diameter (c) .....	37.5 mm
Height (d) .....	45.14 mm
Thrust plate thickness .....	3.95 to 4.05 mm

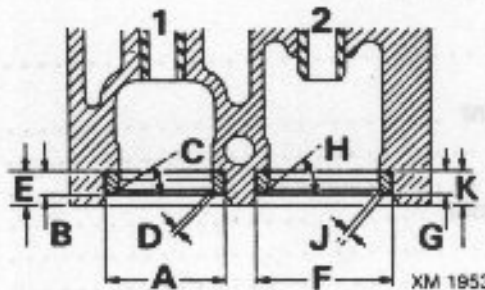
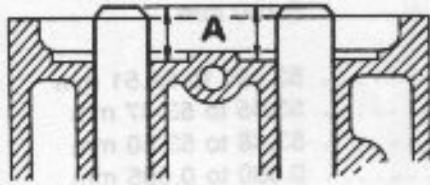
# ENGINE

## Tappets

Outside diameter .....	14.965 to 14.985 mm
Rocker gear:	
Shaft diameter .....	21.979 to 22.00 mm
Bush internal diameter .....	22.020 to 22.041 mm
Assembly clearance .....	0.020 to 0.062 mm
Wear limit between bush and shaft .....	0.2 mm

## Valves

Valve clearance - Inlet/Exhaust - Engine Cold .....	0.30 mm
Face angle:	
Inlet .....	55° 30'
Exhaust .....	45° 30'
Head diameter:	
Inlet .....	40.05 to 40.25 mm
Exhaust .....	33.8 to 34.0 mm
Head stand down:	
Inlet .....	0.80 to 1.20 mm
Exhaust .....	0.79 to 1.19 mm
Stem diameter:	
Inlet .....	7.940 to 7.960 mm
Exhaust .....	7.920 to 7.940 mm
Clearance in guide:	
Inlet .....	0.040 to 0.075 mm
Exhaust .....	0.060 to 0.095 mm
Valve guides	
Inside diameter .....	8.0 to 8.015 mm
Fitted height (above spring plate counterbore) .....	13.5 to 14 mm



## Valve seat insert machining dimensions

Exhaust - 1 .....	Valve seat insert machining dimensions
A .....	36.066 to 36.050 mm
B .....	7.00 to 7.05 mm
C .....	
D .....	1.65 to 2.05 mm
E .....	10.51 to 10.25 mm
Inlet - 2	
F .....	42.070 to 42.086 mm
G .....	7.14 to 1.19 mm
H .....	
J .....	1.8 to 2.2 mm
K .....	10.3 to 10.4 mm

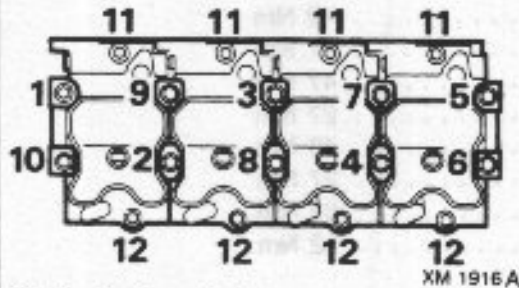
## Valve Springs

Free length .....	44.65 mm
Fitted length .....	38.6 mm
Load at fitted length .....	333 ± 13 N
Load at top of lift .....	907 ± 13N
Number of coils .....	5.33



**TORQUE SETTINGS**

Sump reinforcing plate bolts	11 Nm
Sump bolts	11 Nm
Longitudinal beam bolts	45 Nm



**Cylinder head bolts:**

Tighten 1 to 10 in sequence	30 Nm
Overcheck by repeating procedure with same torque	
Then in sequence tighten a further 70° then another 70°	
Tighten 11 then 12	80 Nm

*Note: Run engine for 20 minutes. Allow to cool (minimum 4 hours)*

*Starting at bolt No. 1 slacken completely then tighten to 30 Nm plus an angle of 120°. Repeat procedure one bolt at a time for bolts No. 2 to 10.*

Tighten 11 then 12	90 Nm
Rocker assembly nuts (lubricate)	108 Nm
Rocker cover nuts	9 Nm
Oil filter head union	37 Nm
Flywheel bolts	20 Nm, then a further 60°
Crankshaft pulley nut	177 Nm
R.H. engine mounting bolts	75 Nm
Engine mounting to body through bolt	45 Nm
Front engine mounting bolts	45 Nm
Engine lower tie rod through bolt	45 Nm
Engine rear tie rod special nut and through bolt	45 Nm
Rear centre engine mounting bolts and 'Torx' screw	45 Nm
Rear centre engine mounting nuts	90 Nm
Front engine mounting to crossmember bolts	45 Nm
Front engine mounting top nut	90 Nm
Rear engine mounting bottom nut	90 Nm
Road wheel nuts	110 Nm
Ball joint to lower arm nut	90 Nm
Suspension fork to shock absorber bolt	60 Nm
Suspension fork to lower arm bolt	90 Nm
Track rod end to steering arm nut	44 Nm
Timing cover upper and lower screws	10 Nm
Timing cover 8 mm screw	24 Nm
Oil pump pick-up pipe strainer bolts	25 Nm
Brake servo vacuum pipe banjo bolt	40 Nm
Engine mounting plate bolts and 'Torx' screw	45 Nm
Upper and lower jockey pulley bolts - L.H. thread	45 Nm
Fuel lift pump/dipstick tube bracket nuts	35 Nm
Fuel pipe banjo bolts	19 Nm
Engine lower tie rod bracket bolts	83 Nm
Exhaust down pipe to intermediate pipe nuts	30 Nm
Power steering pipes clamp bolts	10 Nm
Engine front mounting bracket nut	85 Nm
Big end bearing cap bolts	29 Nm then a further 60°
Fuel injection pump timing gear nut	88 Nm
Oil pump Allen screws	27 Nm

# ENGINE

Oil cooler pipe unions . . . . .	30 Nm
Oil cooler nuts . . . . .	25 Nm
Oil pipe to thermostatic valve union . . . . .	74 Nm
Thermostatic valve blanking plug . . . . .	37 Nm
Centre main bearing carrier Allen screws	
Bearing internal diameter check . . . . .	54 Nm
Final tighten to . . . . .	42 Nm
Engine backplate/rear main bearing carrier Allen screws . . . . .	27 Nm
Engine backplate nuts and bolts . . . . .	47 Nm
Brake servo vacuum pump Allen screws . . . . .	27 Nm
Brake servo vacuum pipe banjo bolt . . . . .	40 Nm
Turbocharger support bracket bolts . . . . .	27 Nm
Starter motor bolts . . . . .	68 Nm
Clutch slave cylinder bolt . . . . .	22 Nm

## TOOL NUMBERS

18G 2	Puller
18G 55A	Piston ring compressor
18G 106A	Valve spring compressor
18G 191	Dial gauge
18G 257	Circlip pliers
18G 257N	Circlip pliers points
18G 284	Gear selector cable remover
18G 284 - 11	Gear selector cable adaptor
18G 705/5	Thrust button
18G 1068B	Universal press
18G 1367A	Crankshaft pulley remover
18G 1370B	Crankshaft remover/replacer
18G 1371	Cylinder liner remover
18G 1373 - 1	Crankshaft main bearing remover/replacer
18G 1374	Crankshaft rear main oil seal replacer
18G 1377	Valve guide remover/replacer
18G 1378	Cylinder liner retainer
18G 1378B	Gauge block
18G 1400 - 1	Adaptors
18G 1584	Ball Joint Separator
18G 1598X	Engine Lift Tilt Adaptor
18G 1614	Auxiliary belt tensioner release
18G 1615 - 1	Injection pump gear remover
18G 1618	Crankshaft pulley retainer
18G 1619	Threaded adaptor
MS 76	Basic handle set
MS 150 - 8	Adjustable pilot - valve seats
MS 621	Adjustable valve seat cutter - exhaust valve inserts
MS 690	Adjustable valve seat cutter - inlet valve inserts

# ENGINE

## \*Gaskets:

Engine type 4924 SHI RG up to No. 97A 05662

### Free thickness

BAU 5092 (0 notches) .....	1.51 to 1.1.59 mm
BAU 5093 (2 notches) .....	1.65 to 1.73 mm
BAU 5094 (1 notch) .....	1.75 to 1.83 mm

### Fitted thickness

BAU 5092 (0 notches) .....	1.42 ± 0.04 mm
BAU 5093 (2 notches) .....	1.52 ± 0.04 mm
BAU 5094 (1 notch) .....	1.62 ± 0.04 mm

Engine type 4924 SHI RG from No. 97A 05662 on and all Engine type 425

## SLI RR

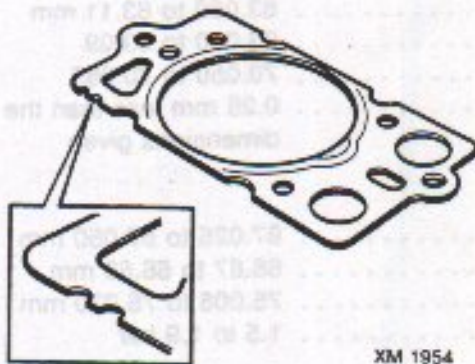
### Free thickness

LVB 10050 (0 notches) .....	1.51 to 1.1.59 mm
LVB 10051 (2 notches) .....	1.65 to 1.73 mm
LVB 10052 (1 notch) .....	1.75 to 1.83 mm

### Fitted thickness

LVB 10050 (0 notches) .....	1.42 ± 0.04 mm
LVB 10051 (2 notches) .....	1.52 ± 0.04 mm
LVB 10052 (1 notch) .....	1.62 ± 0.04 mm

\* See Pistons



## End plates

Height .....	91.26 to 91.34 mm
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## Connecting rods

Weights (connecting rod complete with small end bush, big - end cap and big - end bolts, but without the big - end shell).

Weight (Letter code L) .....	1156 to 1172 gramme
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## Small end bush

### Internal diameter:

Minimum .....	30.030 mm
Maximum .....	30.045 mm

Wear limit between bush and gudgeon pin .....	0.100 mm
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### Big end bearings:

Standard .....	53.977 to 54.016 mm
Internal diameter .....	53.977 to 54.016 mm
Bearing undersizes: .....	0.25 mm (less than the dimension given)